AN ANALYSIS OF THE IMPLEMENTATION OF ACQUISITION REFORM

INITIATIVES AND CONTRACT COST VARIANCE

THESIS

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AFIT/GCA/ENV/03-03

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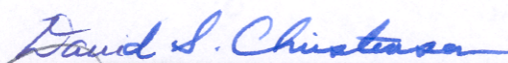
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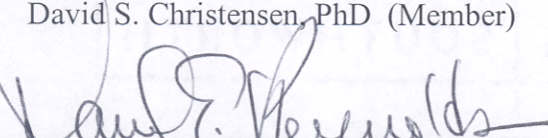
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Mark Holbrook

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Abstract

This thesis examines the impact of acquisition reform initiatives implemented since 1993 on contract cost performance. Many initiatives implemented during the 1990s focused on saving the government money in procuring weapon systems. For decades, cost overruns have plagued Department of Defense weapons systems development and procurement costing the government money. The passage of the Federal Acquisition Streamlining Act (FASA) of 1994 and the Clinger-Cohen Act of 1996, marked significant congressional action on aiding the Department of Defense develop and procure systems cheaper. Conclusions drawn in this thesis may aid leadership in supporting current initiatives and drafting new changes.

This research effort studied 204 contracts completed between January 1, 1994 and December 31, 2001. It was discovered that cost performance for contracts completed after reform initiative implementation was no different than cost performance on contracts completed before implementation. The research also analyzed cost performance on all active contracts from 1970 to 2002 against the backdrop of acquisition reform studies and commissions over the same time period, to examine any trends or time lags between reform implementation and contract cost performance change. The results indicate some evidence of cost performance change following the different studies and commissions. Possible explanations and implications of these results, and suggestions for future research are provided.

AN ANALYSIS OF THE IMPLEMENTATION OF ACQUISITION REFORM

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I. Introduction

We must do more with less.
               - The list is long

General Issue

The decade of the 1990s was a period of change for the United States military,

both operationally and budgetary. The end of the Cold War and the success of Operation

Desert Storm resulted in increased operations tempo, a personnel reduction of 34%, and a

budget reduction of 40% (Cordesman, 1999: 2-3; CBO, 2000: 1-2). The "Do More With

Less" adage was born and became a common statement among Department of Defense

(DoD) leadership.

The Clinton Administration's first term faced these issues head on. The military's

worldwide tasking and deployments increased as overseas bases were closed and

remaining bases faced aging facilities and infrastructure in need of repair, all requiring

additional funds (CBO, 2000: 1-2).   At the same time, the DoD continued to develop and

procure new weapon systems and modifications to existing weapon systems, which were

more technologically advanced and more expensive than legacy systems (Goure, 2000:

1). To make the federal budget pieces fit, funding for national defense decreased in order

to keep day-to-day operations running (see Figure 1). In fact, procurement spending

declined by 59% between fiscal years 1987 to 1997 (CRS Report, 2001: CRS-2).
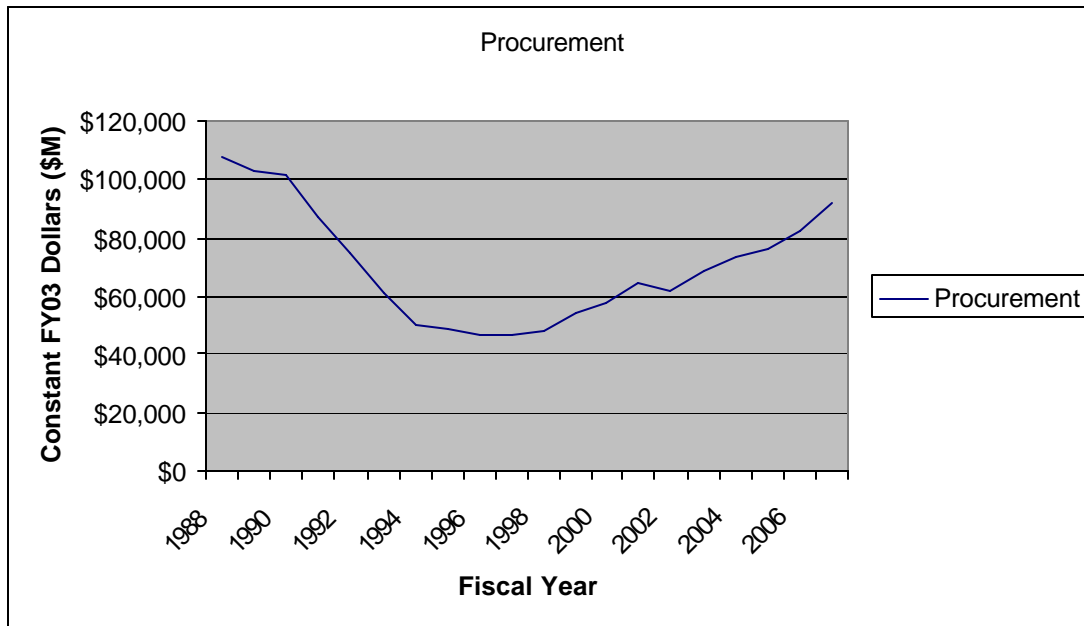
Figure 1. DoD Budget Authority (DoD FY03 Budget Greenbook: 114-115)

In order to continue some level of modernization, the acquisition and procurement

process within the federal government, and more specifically, within the DoD required

change. Acquisition Reform, as we know it today, was reintroduced in an effort to

procure weapon systems better, faster and cheaper (CRS Report, 2001: CRS-2).

Specific Issue

The defense acquisition system experienced "reform" movements in the 1970s

and the 1980s. Despite reform focused on reducing costs, research shows that weapon

system programs continued to overrun cost and schedule constraints (Searle, 1997). In

fact, a 1993 RAND study indicated that cost growth of DoD programs since the mid

1960s fluctuated around 20 percent (Drezner and others, 1993:20). The last three DoD

Acquisition chiefs lauded the current Acquisition Reform movement successful. However, some are not so optimistic and pleased with the results. In April 2000, before the Senate Armed Services Committee Readiness Subcommittee, Senator Carl Levin stated that many contracts have failed to use or have overused the increased flexibility provided by Acquisition Reform and therefore, have not realized cost reductions. Current research on this subject is optimistic and indicates that contract cost performance woes are on the rebound and that Acquisition Reform initiatives are in fact reducing the cost of buying new weapon systems (Christensen and Templin, 2002).

Scope and Limitations of the Study

This study focuses on the timeline of current reform initiative implementation, with an emphasis on cost reduction-focused initiatives. This study assesses if DoD weapon system contract cost performance is improving or not and how any cost performance trends (positive or negative) relate to the implementation timeline. The Defense Acquisition Executive Summary (DAES) database will be analyzed to perform the program cost performance assessment.

There are two limitations in this study important to note. First, based on prior and current research, the analysis assumes that Acquisition Reform initiatives prior to the Clinton Administration had no positive effect on the contract cost performance and therefore, any changes in performance are a result of the current reform movement. Second, because only seven years have passed since the current Acquisition Reform movement started, the full impact and success cannot be assessed in this study.

Research Objectives

        This research study has two main objectives. First, to determine if a mapping between cost initiatives and cost growth improvement exists and if so, what is the time period between implementation of an initiative and the results. Based on this relationship, the focus will be on developing a model or "rule of thumb" to estimate or forecast an impact window or time frame in which to expect results for future cost-related Acquisition Reform policies. The end goals are to provide some evidence to DoD leadership that Acquisition Reform is positively affecting contract cost performance and to provide evidence that it takes time for such initiatives to bear fruit. Successful accomplishment of these goals would allow DoD to use this evidence in the future when implementing, supporting and justifying new changes to the Acquisition process and assessing associated results.

        In order to achieve these objectives, the analysis is broken into phases. Phase One will analyze and compare contract cost performance for pre- and post-reform periods to see if there are indications that acquisition reform initiatives are having an impact, either positive or negative. Phase Two will look at contract cost performance over time to see if there is a "rule of thumb" relationship between acquisition reform initiatives and cost performance improvement. Dependent upon the results of Phase One and Phase Two, a third phase of analysis will be conducted with different pre- and post-reform periods used to see if there are indications of cost performance impact.

Organization of the Study

This chapter established the motivation for analyzing the topic and the research objectives. Chapter 2 describes past and present Acquisition Reform efforts, describes Earned Value Management and provides details on past research in this subject area. Chapter 3 details the methodology used to analyze the cost performance and rule of thumb development and Chapter 4 provides the results of the analysis. Finally, Chapter 5 provides conclusions from the study and recommendations for further research.

II. Literature Review

DoD has achieved a large measure of success with Acquisition Reform.
        - Honorable Paul G. Kaminski, USD(A&T)
                26 February 1997

Real reform in our acquisition of weapons and major systems has taken place in recent years.
        - Honorable Jacques S. Gansler, USD(A&T)
         Testimony before Subcommittee on Acquisition and Technology of the Senate Armed Services Committee, 18 March 1998

These reform initiatives are so obligatory with each change at the helm that they can bring a "same package, different name" quality with them. It's a shame-but not a surprise-that so much cynicism has grown around such a worthy word as reform.
        - Honorable E.C. "Pete" Aldridge, USD(AT&L)
                30 April 2002

Chapter Overview

This chapter provides a brief overview, historical and current, of Acquisition Reform efforts, a description of the Earned Value Management system utilized to assess Department of Defense (DoD) program cost performance, and a review of past research conducted in analyzing Acquisition Reform and DoD contract cost performance.

Acquisition Reform

The historical overview starts with Deputy Secretary of Defense David Packard's changes in the 1970s and concludes with the 1989 Defense Management Report. The current reform overview begins with the National Performance Review (NPR) and concludes with a focus on initiatives that affect cost performance and cost control.

Historical Acquisition Reform Overview (1970's – 1992)

Table 1 lists several defense acquisition studies conducted from the 1960s through the 1980s. This historical reform overview will focus on those highlighted, as these are the major acquisition studies orchestrated by the Executive Branch.

Table 1. Significant Defense Acquisition Studies (Jones, 1996:405)

Report by	Issued
Peck & Scherer (Harvard Business School)	1962, 1964
Blue Ribbon Defense Panel (Fitzhugh Commission)	1970
Commission on Government Procurement	1972
J. Ronald Fox (Harvard Business School)	1974
Military Services and Secretary of Defense	1974-75
Defense Science Board Summer Study (Acquisition Cycle Task Force)	1977
Defense Resources Board	1977
DoD Resource Management Study	1979
Jacques S. Gansler	1980
Acquisition Improvement Task Force (Carlucci Initiatives)	**1981**
Special Panel on Defense Procurement Procedures	1982
Grace Commission	**1983**
Special Task Force on Selected Defense Procurement Matters	1984
Georgetown Center for Strategic and International Studies	1985
Blue Ribbon Commission on Defense Management (Packard Commission)	**1986**
Defense Management Review	**1989**

Packard

The Vietnam War and rising weapon system procurement costs created a Defense Department spending draw down (Jones, 1999: 402). Secretary of Defense Melvin Laird and his Deputy, David Packard, realized the need for better control over the acquisition process (Ferrara, 1996:110). In 1969, Secretary Packard returned the authority for the acquisition process to the military services and created the Defense Systems Acquisition Review Council (DSARC) to act as the advisory group to the Defense Secretary (Ferrara, 1996:111; Jones, 1999:402). With the creation of the DSARC, Secretary Packard established milestones and phases to monitor and assess program status and to streamline the acquisition process (Jones, 1999:403).

In May 1970, Secretary Packard issued a memorandum listing broad themes such as decentralized execution, streamlined management structures and use of appropriate contract mechanisms (Ferrara, 1996:111). This memorandum would become the foundation for DoD Directive (DoDD) 5000.1, completed in July 1971 (Ferrara, 1996:111). Secretary Packard's vision was the following:

> Successful development, production, and deployment of major defense systems are primarily dependent upon competent people, rational priorities, and clearly defined responsibilities. Responsibility and authority for the acquisition of major defense systems shall be decentralized to the maximum practicable extent consistent with the urgency and importance of each program.
>
> The development and production of a major defense system shall be managed by a single individual (program manager) who shall have a charter that provides sufficient authority to accomplish recognized program objectives. Layers of authority between program manager and his Component Head shall be minimum…[the] assignment and tenure of program managers shall be a matter of concern to DoD Component Heads and shall reflect career incentives designed to attract, retain, and reward competent personnel (Ferrara, 1996:111).

The final section of DoDD 5000.1 contained the following guidance:

- Wherever feasible, operational needs shall be satisfied through the use of existing military or commercial hardware;

- Practical tradeoffs shall be made between system capability, cost, and schedule;

- Logistic support shall be considered as a principal design parameter;

- Schedules shall be structured to avoid unnecessary overlapping or concurrency;

- Test and evaluation shall commence as early as possible;

- Contract type shall be consistent with all program characteristics, including risk;

- Source selection decisions shall take into account the contractor's capability;

- Develop a necessary defense system on a timely and cost-effective basis; and

- Documentation shall be generated in the minimum amount to satisfy necessary and specific management needs.

Packard's early ideology established acquisition reforms that DoD still operates under today. Packard's vision would be reflected in the studies that followed over the next 30 years.

Carlucci Initiatives

The Acquisition Improvement Task Force, also known as the Defense Acquisition Improvement Program or the Carlucci Initiatives, was directed by Secretary of Defense Casper Weinberger in 1981 to look at all aspects of defense acquisition (Ferrara, 1996:118; Jones, 1999:406). The "Reagan buildup" of the 1980s required reductions in weapon system costs and development durations (Jones, 1999:406). Led by Deputy Secretary of Defense Frank Carlucci, the task force resulted in 32 initiatives (Table 2) to improve the acquisition process. However, due to a lack of acceptance from Congress and industry, coupled with rumors of fraud, waste and abuse, most of the 32 initiatives were never implemented (Gregory, 1989:60). Initiatives that survived addressed multi-year procurement and fixed-price contracts, greater competition, stabilized programs and realistic budgeting (Jones, 1999:406). These initiatives made their way into the acquisition process with the 1982 revision of DoDD 5000.1, as evidenced by this excerpt from the 1982 version:

> Improved readiness and sustainability are primary objectives of the acquisition process…. Reasonable stability in acquisition programs is necessary to carry out effective, efficient, and timely acquisitions. To achieve stability, DoD Components shall conduct effective evolutionary alternatives, estimate and budget realistically, [and] plan to achieve economical rates of production (Ferrara, 1996:119).

Table 2. Carlucci Initiatives (Adams, 1984, 15)

1. Reaffirm Acquisition Management Principles	17. Decrease DSARC Briefing and Data Requirements
2. Increase Use of Preplanned Product Improvement	18. Budget for Inflation
3. Implement Multiyear Procurement	19. Forecast Business Base Conditions
4. Increase Program Stability	20. Improve Source Selection Process
5. Encourage Capital Investment to Enhance Productivity	21. Develop and Use Standard Operation and Support Systems
6. Budget to Most Likely Costs	22. Provide More Appropriate Design-to-Cost Goals
7. Use Economical Production Rates	23. Implement Acquisition Process Decisions
8. Assure Appropriate Contract Type	24. Reduce DSARC Milestones
9. Improve System Support and Readiness	25. Submit MENS (later JMSNS) with Service POM
10. Reduce Administrative Costs and Time	26. Revise DSARC Membership
11. Budget for Technological Risk	27. Retain USDR&E as Defense Acquisition Executive
12. Provide Front-end Funding for Test Hardware	28. Raise Dollar Threshold for DSARC Review
13. Reduce Governmental Legislation Related Acquisition	29. Integrate DSARC and PPBS Process
14. Reduce number of DoD Directives	30. Increase PM Visibility of Support Resources
15. Enhance Funding Flexibility	31. Improve Reliability and Support
16. Provide Contractor Incentives to Improve Reliability	32. Increase Competition
	33. Enhance the Defense Industrial Base (added 1984)

The General Accounting Office (GAO) completed a final report analyzing the Carlucci Initiatives in July 1986 (Munechika, 1997:8). The GAO concluded, "top level commitment to change did not filter down to the program manager level" and that the "commitment to the improvement program ha[d] dissipated" (GAO, 1986:2; Munechika, 1997:8). In fact, after only five years implementing the Carlucci Initiatives, the DoD was moving forward with the plan of monitoring results of the initiatives, resulting in the lack of success (Munechika, 1997:9).

Grace Commission

On June 30, 1982, President Reagan established the President's Private Sector Survey on Cost Control (PPSSCC) under the guidance of J. Peter Grace, to identify opportunities for better efficiency and reduced costs that could result from any form of executive or legislative action (US Congress, 1984:2). This survey group was recognized as the Grace Commission. The Grace Commission consisted of 161 chief executive

officers of major corporations and private sector experts, and totaled more than 2,000

total participants (US Congress, 1984:3).

The Grace Commission submitted 2,478 recommendations to the President on

reforms for the government (US Congress, 1984:24). Only 112 of the 2,478 pertained to

DoD operations, and 21 of the 112 involved changes to the acquisition process (US

Congress, 1984). The major recommendations are listed below in Table 3.

Table 3. Grace Commission Recommendations (House Armed Services Committee, 1985:3)

1. Greater use of multiyear contracting to improve program stability
2. Prioritize all weapons systems
3. Streamline and strengthen the contract selection process
4. Upgrade cost estimating
5. Enhance the role, responsibility, authority and accountability of the PM
6. Increase the use of dual sources, throughout the life of the program
7. Increase emphasis on the Spare Parts Breakout Program to identify and obtain spare parts from sources other than the Prime Contractor
8. Consolidate responsibility for contract administration activity at the level of OSD
9. Simplify/streamline the 30,000 pages of regulation related to Defense procurement
10. Mandate use of common components, subsystems and equipment by all services
11. Eliminate the use of unnecessary military specifications
12. Outsource commercial functions
13. Incentivize government employees

The only shortfall with the Grace Commission was that the recommendations

came shortly after the Carlucci Initiatives were published. The DoD believed they

addressed the Commission recommendations by instituting the Carlucci Initiatives

(Munechika, 1997:12). Therefore, the Grace Commission recommendations for

acquisition reform eventually faded away much like many of the Carlucci Initiatives

(Munechika, 1997:12).

Packard Commission

On July 15, 1985, responding to continued stories of acquisition problems and contractor overcharging, President Reagan initiated the Blue Ribbon Commission on Defense Management, chaired by former Deputy Defense Secretary David Packard (Munechika, 1997:12; Jones, 1999:407). The Packard Commission focused on broad organizational changes and would become the Reagan Administration's most recognized acquisition reform movement (Jones, 1999:407). The Commission's charter was to review and make recommendations in the following areas:

- Adequacy of the defense acquisition process, industrial base and current law and regulations;

- Adequacy of current authority and control of Secretary of Defense;

- Responsibilities of the Joint Chiefs of Staff;

- Adequacy of the Unified and Specified Command system in providing effective planning and use of forces;

- Value and continued role of intervening layers of command on military forces;

- Procedures for developing and fielding military systems incorporating new technologies in a timely fashion;

- Congressional oversight and investigative procedures relating to the DoD;

- Recommend how to improve the effectiveness and stability of resources allocation for defense (Blue Ribbon Commission, 1996:27-28).

The Commission examined how to make the military acquisition system more efficient like commercial organizations (Munechika, 1997:13). By June 1986, less than one year from organizing, the Commission submitted the final report. Table 4 shows the Packard Commission's Formula for Action to make the process more efficient.

Table 4. Packard Commission's Formula for Action

A. Streamline Acquisition Organization and Procedures
   1. Create new Under Secretary of Defense for Acqusition position
   2. Each service should establish a comparable Service Acquisition Executive (SAE)
   3. Each SAE should appoint Program Executive Officers (PEO)
   4. Program managers report directly to PEOs
   5. Substantially reduce the number of acquisition personnel
   6. Recodify federal laws into a single, greatly simplified statute

B. Use Technology to Reduce Cost
   1. Emphasize building and testing prototypes to demonstrate new technology
   2. Operational testing should begin early in development
   3. Prototypes can provide a basis for improved cost estimating

C. Balance Cost and Performance
   1. Restructure Joint Requirements and Management Board leadership
   2. Joint Requirements Management Board should define weapon requirements and provide
      tradeoff between cost and performance

D. Stabilize Programs
   1. Baseline programs and use multi-year funding

E. Expand the Use of Commercial Products
   1. Do not rely on military specifications
   2. Use off-the-shelf products as much as possible

F. Increase the Use of Competition
   1. Focus on more effective competition, modeled on commercial practices
   2. Emphasize quality and past performance as well as price

G. Enhance the Quality of Acquisition Personnel
   1. Allow Secretary of Defense to establish flexible personnel management practices
   2. Recommend new personnel management system for acquisition personnel,
      contracting officers and scientists and engineers

On April 2, 1986, President Reagan signed a directive to implement the Packard

Commission's recommendations (Blue Ribbon Commission, 1996:33). The Packard

Commission laid the groundwork for the passing of both the Goldwater-Nichols Act and

the Defense Acquisition Improvement Act of 1986; both contained sweeping changes to

the acquisition process and overall DoD management (Munechika, 1997:15). Also, the

applicable Packard Commission recommendations were written into a new version of the

DoDD 5000.1; specifically the new chain of authority (Ferrara, 1996:120).

By 1990, the progress reports on the Packard Commission recommendations were

positive. Particular emphasis had been placed on program stability and cost control

(Munechika, 1997:15). The same report noted that only the enhancement of the DoD

acquisition personnel portion of the Formula for Action was not a success story

(Munechika, 1997:15). The Bush Administration would take an aggressive look at this

"success" upon taking office in 1989.

Defense Management Report

Upon taking office in 1989, President Bush requested a National Security Review

with the goal of developing a plan to fully implement the Packard Commission

recommendations, further improve the defense acquisition system, and better manage the

DoD (Cheney, 1989:i). The Defense Management Report (DMR) was completed in July

1989. The DMR took an analytical view of the DoD based on the Packard Commission

recommendations and assessed how far along the department was in implementation and

most importantly, what remained to be accomplished. Secretary of Defense Cheney

noted that to realize President Bush's objectives for improving the acquisition process,

the following would need to occur:

- Teamwork among DoD's senior managers;

- Sound, longer-range planning and better means for managing available resources;

- More discipline in what weapon systems we buy and how we buy them;

- Better management of the people we rely on to produce such systems;

- An environment that promotes steady progress in cutting costs and increasing quality and productivity; and

- Adherence to the highest ethical standards (Cheney, 1989:27).

Notable improvements included chartering the Joint Requirements Oversight

Council (JROC) to enhance the requirements generation and weapon system validation;

establishing an Acquisition Corps and improving professional education and training; strengthening the role of the Under Secretary of Defense for Acquisition; and consolidating the contract administration functions under a single organization - the Defense Logistics Agency (Munechika, 1997:16; Jones, 1999:404). The DMR concluded with a vitally important point; actions will take time, effort, consensus and commitment (Cheney, 1989:27).

By the end of 1991, major steps in implementing many of Secretary Cheney's recommendations had occurred. The Defense Contract Management Command (now Agency) was created under the Defense Logistics Agency, consisting of a reduction to five district offices and manpower reductions in all offices (Munechika, 1997:16). To address the discipline issues, the DoDD 5000 series was expanded significantly. The new series contained clear guidelines with an attempt to streamline the regulation regime by consolidating all previous directives, instructions and policy memoranda (Ferrara, 1996:121; Munechika, 1997:17). As a result, the new series contained over 900 pages and was more than 15 times larger than any previous version.

<u>Summary</u>

This section provided a brief overview of some of the major acquisition reform initiatives between 1970 and 1992. From a historical point of view, it is evident that while the reform studies and commissions have changed names, many of the ideas and recommendations remained the same between Packard (1970), Carlucci (1981), Grace (1983), Packard (1986) and the Defense Management Report (1989).

Current Acquisition Reform Overview (1993 – Today)

This section defines the current acquisition reform period as the reform initiatives that began with the Clinton Administration, specifically the National Performance Review, led by Vice President Gore. This section focuses on the National Performance Review (NPR) conclusions, the resulting legislative changes, and concludes with a synopsis of reform initiatives that have had a direct focus on cost control.

National Performance Review

The National Performance Review (NPR) was a similar review to what the Grace Commission accomplished 10 years prior, in that it performed a detailed look at all government activities to find areas for improvement. The first report was released on 7 September 1993 (Munechika, 1997:31). This report contained 384 recommendations that spanned all facets of government operations, including federal procurement (Munechika, 1997:31). The NPR pointed out that in the DoD, there were at least 889 laws affecting procurement, the Federal Acquisition Regulation (FAR) was over 1,600 pages, and was further supplemented with over 2,900 pages of agency-specific procurement regulations (Reinventing Federal Procurement, 1993:5). Table 5 gives a brief layout of the recommendations for procurement reform that came out of the NPR.

Analyzing the list, it is easy to discern similarities between prior commission recommendations and issues identified by the NPR. In 1995, the NPR reconvened and accomplished a second assessment to look for any governmental functions that could be terminated, privatized or restructured (National Partnership for Reinventing Government, 1999). The actual savings suggested by the NPR are contested between what the Clinton Administration estimated versus what the General Accounting Office (GAO) and other

private groups could estimate. For the purposes of this report, the true savings are not important. The importance of the NPR is that it reinvigorated the Acquisition Reform movement in the DoD (Munechika, 1997:31).

Table 5. National Performance Review Procurement Reform Recommendations (Reinventing Federal Procurement, 1993)

PROC01	Reframe Acquisition Policy
	- Reduce rules and regulations
PROC02	Build an Innovative Procurement Workforce
	- Better education and training
PROC03	Encourage More Procurement Innovation
	- Test new methods with pilot programs
PROC04	Establish New Simplified Acquisition Threshold and Procedures
	- Low cost procedures for small purchases
PROC06	Amend Protest Rules
	- Increased communication between buyers and sellers
PROC08	Reform Information Technology Procurement
	- Decrease time to purchase computer equipment
PROC09	Lower Costs and Reduce Bureaucracy in Small Purchases Through the Use of Purchase Cards
	- IMPAC Card use
PROC13	Foster Reliance on the Commercial Marketplace
	- Reduce reliance on government-specific specifications
PROC15	Encourage Best Value Procurement
	- Lowest bidder is not always best!
PROC16	Promote Excellence in Vendor Performance
	- Use past performance in contract award decisions
PROC18	Authorize multiyear contracts
PROC19	Conform Certain Statutory Requirements for Civilian Agencies to Those of Defense Agencies
	- Raise minimums for cost and pricing data certification

Federal Acquisition Streamlining Act (FASA) of 1994

The FASA of 1994 incorporated much of Vice President Gore's NPR recommendations for creating a "government that works better and costs less" (FASA DSMC, 2002). The intent was to overhaul the cumbersome and complex procurement system of the federal government and, more importantly, the DoD (FASA DSMC, 2002). Table 6 highlights some of the changes included in the FASA of 1994.

Table 6. Federal Acquisition Streamlining Act of 1994 (FASA DSMC, 2002)

- Eliminated paperwork and record keeping requirements

- Allowed direct micropurchases

- Exempted commercial purchases from cost and pricing data
    and cost accounting standards

- Reserved small dollar acquisitions for small businesses

- Improved bid protest and contract administration procedures

- Required evaluation of past performance before contract award

- Raised Truth in Negotiation Act threshold for required cost and
    pricing data

The result of the new law caused a ripple in the federal and defense regulations related to acquisition and program management. In fact, the new reform push started before passage of the law. In June 1993, Colleen Preston was appointed as the Deputy Under Secretary of Defense for Acquisition Reform [DUSD(AR)] (Munechika, 1997:31). In 1995, Under Secretary of Defense for Acquisition and Technology (USD[AT&L]), Paul Kaminski called for the revision of the DoD 5000 series to incorporate the new flexibility and streamlined practices created by the FASA of 1994 (DoD Directive 5000 Series rewrite DSMC, 2002). In fact, the FASA required that all federal regulation change proposals be published not later than 210 days after the law was enacted (GAO/NSIAD-96-139:1).

Title V of the FASA of 1994 contained provisions for performance-based acquisition management designed to foster the development of 1) measurable cost, schedule, and performance goals, and 2) incentives for acquisition personnel to reach these goals (GAO/NSIAD-97-22BR:1). At the time of the GAO's report, the DoD had

complied with the applicable part of Title V (part 1) by Fiscal Year 1995 (GAO/NSIAD-97-22BR:2).

Clinger-Cohen Act of 1996

In 1996, Congress enacted the Information Technology Management Reform Act and the Federal Acquisition Reform Act (Clinger-Cohen DSMC, 2002). These two acts together are better known today as the Clinger-Cohen Act. A quote by Under Secretary of Defense for Acquisition and Technology, Paul Kaminski, summarizes what the act accomplished:

> The Clinger-Cohen Act of 1996 (formerly known as the Federal Acquisition Reform Act of 1996 (FARA) and the Information Technology Management Reform Act of 1996 (ITMRA)) further advance the changes made by FASA. The Clinger-Cohen Act provides a number of significant opportunities for DoD to further streamline and reduce non-value added steps in the acquisition process. Among the most significant changes authorized by the Act is a test of the use of the Simplified Acquisition Procedures (SAP) for commercial items between the simplified acquisition threshold of $100,000 and $5 million. This should allow DoD to reduce its administrative costs and overhead costs for DoD's vendor base for purchases of relatively low risk items. This change eliminated government-unique requirements previously cited by industry as a barrier to doing business with DoD. The Act also provides the authority for contracting activities to use SAPs for all requirements between $50,000 and the SAP while the government works to fully implement Electronic Commerce/Electronic Data Interchange (EC/EDI). (Clinger-Cohen DSMC, 2002)

Important to the analysis of cost growth, and more specifically cost variance, is that the Act provided some relief from cumbersome and non-value added processes that increased costs of programs (Clinger-Cohen DSMC, 2002). Additionally, the Clinger-Cohen Act established statutory standards for acquisition personnel and required each federal agency involved in procurement to budget funds specifically for education and training (AFMC Acquisition Reform Guide, 1999:5). This was a key step forward.

Personnel would not be able to utilize the new flexibility and concepts unless they were trained and educated first.

<u>Summary</u>

Current period reform initiatives are not conceptually different from ideas presented in the previous section. The major difference was the direct involvement of Congress in mandating changes in procedures and regulations to provide increased flexibility. The enactment of the FASA of 1994 implemented much of the NPR recommendations. The enactment of Clinger-Cohen of 1996 (FASA II) further enhanced the groundwork established two years earlier. The next section provides additional detail for specific changes implemented by the DoD to take advantage of the new flexibility and attempt to make headway into controlling, and ultimately reducing, the cost of defense procurement.

Review of Implemented Initiatives

Integrated Product and Process Development

Integrated Product and Process Development (IPPD) is a concept used by private

industry since the early 1980s and now "borrowed" by the DoD (DoD Guide to IPPD,

1996:1-2). At the core of IPPD implementation is the use of Integrated Product Teams

(IPTs) (DoD Guide to IPPD, 1996:ix). Figure 3 provides a graphical representation of

the IPPD process.
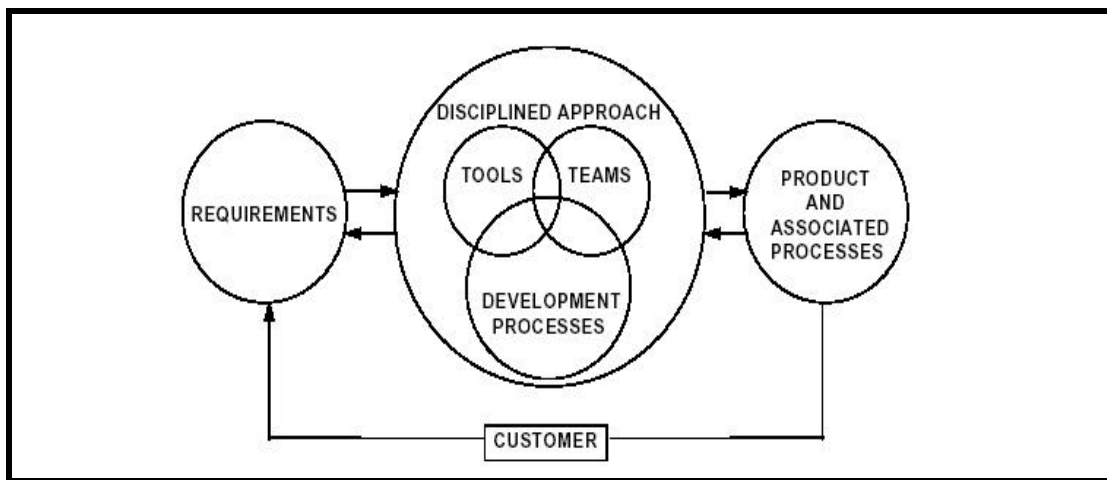
Figure 2. Generic IPPD Iterative Process (DoD Guide to IPPD, 1996).

IPPD is defined as the following:

> A management process that integrates all activities from product concept
> through production/field support, using a multi-functional team to
> simultaneously optimize the product and its manufacturing and
> sustainment processes to meet cost and performance objectives. (DoD
> Guide to IPPD, 1996:1-3)

Proper implementation of the IPPD process requires an understanding of the key

tenets. The tenets are self-explanatory from their titles and are listed in Table 7.

Table 7. Key Tenets of IPPD (DoD Guide to IPPD, 1996:1-7 – 1-8)

1. Customer Focus
2. Concurrent Development of Products and Processes
3. Early and Continuous Life Cycle Planning
4. Maximize Flexibility for Optimization and Use of Contractor Approaches
5. Encourage Robust Design and Improved Process Capability
6. Event-Driven Scheduling
7. Multidisciplinary Teamwork
8. Empowerment
9. Seamless Management Tools
10. Proactive Identification and Management of Risk

A 28 April 1995 memorandum from the Under Secretary of Defense for Acquisition, Technology and Logistics, Paul Kaminski and a 10 May 1995 memorandum from the Secretary of Defense William Perry officially initiated the DoD's push for IPPD development and use (Ferrara and Johnson, 1995:4).

The DoD leadership objectives for IPT are contained in Table 8. Under Secretary of Defense Kaminski pointed out that the use of teams "allows for early-on and continuous insight by all stakeholders in a program" (FAR Rewrite DSMC, 2002).

Table 8. DoD IPT Objectives (Ferrara and Johnson, 1995:2)

- Creation of an acqusition system that capitalizes on the strengths of all participants in the acquisition process to develop programs with the highest opportunity for success.
- Fostering the early and active participation of OSD and Component staff organizations with program office teams to develop a sound and executable acquisition strategy, and identify and resolve issues as they arise, not during the final decision meeting.
- Transforming historically adversarial relationships, especially between headquarters staff organizations and program office teams, into productive partnerships.
- Placing renewed emphasis on the importance of working as cross-functional teams to maximize overall performance.

In 1993, Wagner and White investigated the F-22 System Program Office (SPO) to see how they were utilizing IPPD and IPTs. Lessons learned consisted of the realization that properly organized and implemented teams were effective and that each

organization must tailor their teams to the respective organization or product/processes involved (Wagner and White, 1993:5-5). The researchers also noted that communication was key to making the process flow smoothly (Wagner and White, 1993:5-6).

Cost as an Independent Variable

Cost as an Independent Variable (CAIV) is the DoD's acquisition methodology for making technical and schedule performance a function of available budget resources (Koreisha and LaPlaca-Mars, 1997). This initiative drives decision makers to consider trading performance away to reduce or maintain cost (CRS Report, 2001:CRS-6). In December 1994, the Defense Manufacturing Council (DMC), headed by the Principal Deputy Under Secretary of Defense for Acquisition and Technology, met to formulate action plans to implement CAIV into the acquisition culture (Focused Approach, 1995:49). The action plan for CAIV implementation is presented in Table 9.

Table 9. CAIV Implementation Action Plan (Focused Approach, 1995:51)

- Develop a DoD integrated team approach (process) to establish mission needs, tradeoffs and cost goals
- Establish a joint Service Acquisition Executive IPT under the auspices of the DMC
- Start the process of changing "values" (within DoD)
- Make unit cost objectives and cost/performance tradeoffs a major topic of each Defense Acquisition Board meeting
- Establish budget and resource planning and analysis procedures compatible with cost/performance tradeoffs as a main acquisition management approach

CAIV strategy entails setting aggressive, realistic cost objectives for acquiring defense systems, and managing risks to obtain those objectives (CAIV Working Group Report, 1995:1). CAIV is made possible through the increased flexibility introduced by both the FASA of 1994 and the Clinger-Cohen Act of 1996. A key element to making

CAIV successful is proper motivation of industry, achieved through competition and contract incentives (CAIV Working Group Report, 1995:7). Competition includes making life-cycle costs a factor in source selection versus the previous way of looking at only near term costs (CAIV Working Group Report, 1995:7). When competition between multiple vendors is not possible, contract incentives can be used to provide profit motivation for contractors to reduce costs (CAIV Working Group Report, 1995:7). The first edition (published in 1996) of DoDD 5000.2R to include CAIV related concepts required each acquisition program to provide incentives to contractors to meet or exceed cost objectives (Gaddis, 1998:35).

Single Process Initiative

In December 1995, Secretary of Defense William Perry and Under Secretary of Defense for Acquisition and Technology, Paul Kaminski, introduced the Single Process Initiative (SPI) (Kaminski, 1997:11). The intent of the SPI was to allow contractors to utilize the same practices and procedures while performing government work as they would while performing commercial work. The requirement to segregate commercial and defense related efforts for similar products adds costs to the end product through increased company overhead costs (Perry, 1994:4). In other words, more processes for the contractor equates to more cost to the government.

The end objectives of implementing the SPI were: 1) save money, 2) obtain a better product, and 3) foster a more competitive industry (Kaminski, 1997:11). SPI forced contractors to consolidate or eliminate multiple processes, specifications, and standards for a product whether it was for commercial or defense (CRS Report, 2001:CRS-6). SPI implementation has allowed greater civil/military integration and

paved the way for greater emphasis on using commercial specifications instead of rigid

and expensive military specifications (Gansler, 1998). The early success of SPI is

indicated in the following quote:

> One of the benchmarks of success in our acquisition reform effort is the
> speed with which we can implement specific cost saving initiatives. This
> is one of the major contributions of the Single Process Initiative. It has
> been a huge success in paving the way for the Department's conversion to
> commercial practices, while already saving almost $500 million in costs.
> - Honorable Jacques S. Gansler, USD(AT&L)
>   29 September 1998, SPI Recognition Awards Ceremony

Earned Value Management

Earned Value Management (EVM) is "a tool that allows both government and

contractor program managers to have visibility into technical, cost, and schedule progress

on their contracts" (DoD EVM Guide, 1997:2). Beginning with the Navy's Polaris

program, the DoD made EVM use policy in 1967 (Abba, 1995:1). At this point, the tool

was known as Cost/Schedule Control Systems Criteria (C/SCSC). The 35 criteria were

adopted from private industry best practices and provided a contractor with minimum

requirements for their management control systems (Abba, 1995:1). During the 1970s

and 1980s the C/SCSC continued to become burdensome and became viewed as

"compulsory financial reporting requirements as opposed to valuable and fundamental

management tools" (Abba, 1995:1).

In 1989, the C/SCSC policy transferred from the control of the DoD Comptroller

to the control of the Under Secretary of Defense for Acquisition (Abba, 1995:1).

However, it took longer for DoD managers to change their attitudes regarding the "value"

of C/SCSC. Following "a series of management disasters", including the Navy's A-12

program, DoD began to view EVM as a vital management control tool (Abba, 1995:2).

The early to mid-1990s saw many refinements to the requirements and to the

implementation practices. This created increased acceptance and use of EVM by

government, industry and foreign countries (Abba, 1995:2). "Earned value, adapted by

DoD nearly 30 years ago from industrial practices, is being readapted to meet

management needs in today's high-tech commercial world" (Abba, 1995:3).

Concepts and Criteria

Program managers and other senior decision makers need insight into how their

acquisition programs are performing, both from a schedule and cost perspective. Use of

an EVM system provides managers with this data which:

- Relate time-phased budgets to specific contract tasks and/or statements of work;

- Indicate work progress;

- Properly relate cost, schedule and technical accomplishment

- Are valid, timely and auditable;

- Supply managers with information at a practical level of summarization; and

- Are derived from the same internal earned value management systems used by the contractor to manage the contract (DoD EVM Guide, 1997:2).

The main premise behind use of the EVM tool is to tailor the system to properly "match"

the using organization, the products, and working relationships involved in the program.

The criteria are general enough to allow for proper tailoring for different contractors,

different contract types, and different projects (DoD EVM Guide, 1997:2). The

"generality" provides contractors flexibility to develop a system that is best suited to their

management needs (DoD EVM Guide, 1997:3). The criteria are utilized to assess

whether a contractor has an acceptable EVM system (DoD EVM Guide, 1997:5).

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What Do EVM Systems Really Do?

At a fundamental level, EVM establishes a structure for management to complete

the steps in Table 10.

Table 10. Brief Summary of EVM Criteria (DoD EVM Guide, 1997:5-8)

```
1. Organization
   - Define the work to be performed
   - Establish the program structure which provides for integration
     of planning, scheduling, budgeting, and control
2. Planning and Budgeting
   - Schedule the work
   - Identify milestones, goal points and other means to measure progress
   - Break work into work packages and establish budgets for work segments
3. Accounting Considerations
   - Record costs in a formal system
   - Track control account budgets to organizational elements
4. Analysis and Management Reports
   - Monthly report of schedule and cost variance
   - Provide detailed explanations for significant variances
   - Complete revised estimates resulting from performance to date
5. Revisions and Data Maintenance
   - Incorporate authorized changes timely (budget and schedule)
   - Prevent unauthorized changes
   - Document changes to the performance measurement baseline
```

Important to this study is the understanding of how EVM tracks work, in terms of

schedule and budget, and how schedule and cost variances are computed. Figure 3

defines different acronyms used in the EVMS to assess schedule and cost performance.

Figure 4 provides a visual depiction how cost and schedule variances are

computed for the analysis and management reports part of EVM. This study focuses on

the cost variances for DoD weapons system acquisition programs.

B C W S	Budgeted Cost for Work Scheduled **PLANNED VALUE**
B C W P	Budgeted Cost for Work Performed **EARNED VALUE**
A C W P	Actual Cost of Work Performed **ACTUAL COST**
B A C	Budget at Completion
E A C	Estimate at Completion

Figure 3. EVM Terminology (Haupt, 2002)

VARIANCES *(Favorable is positive, Unfavorable is negative)*

- Cost Variance $CV = BCWP - ACWP$ $CV \% = CV / BCWP$
- Schedule Variance $SV = BCWP - BCWS$ $SV \% = SV / BCWS$
- Variance at Completion $VAC = BAC - EAC$
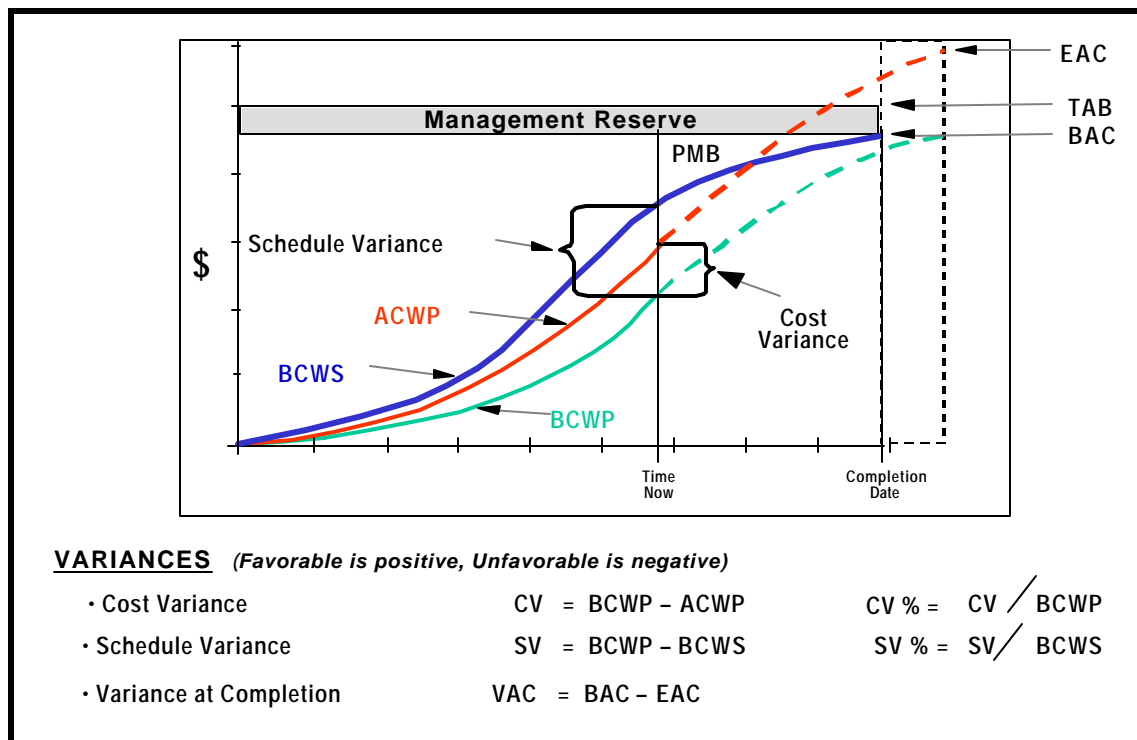
Figure 4. EVM Variance Analysis (DSMC Gold Card, 2000).

The complete DSMC Gold Card can be found in Appendix A. The Gold Card provides

detail on what makes up the Performance Measurement Baseline (PMB) and a pictorial

view of how work is broken into work and planning packages. It is important to note that

BCWP = BCWS at the end of a contract. For this reason, the focus of this analysis is

solely on cost variance.

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From Figure 4, it becomes apparent why EVM is such a valuable tool to the program manager. At any point in time, a program can be assessed as to how complete the program is and how the program is spending budgetary resources compared to the plan.

Summary

This section provided detail as to how EVM came to be and provided some detail on how a program manager uses EVM tools. This study will utilize EVM data to analyze how cost variances have changed during and after reform and to determine if there are discernable time lags between reform and cost variance perturbations.

Past Research

This section summarizes different research studies related to effectiveness of acquisition reform and to program cost growth and cost variance. These studies and their results motivated this study and provided insight into methodology and analysis.

Drezner Study

Drezner et al. conducted an empirical study in 1993 to quantify the magnitude of cost growth in weapon systems and to identify factors affecting cost growth (Drezner et al., 1993:xi). The Drezner study utilized Selected Acquisition Reports (SAR) data to calculate the cost growth for DoD programs. The research looked at SAR data for 197 DoD programs as of December 1990, and found that little improvement has occurred over time and that cost growth has fluctuated around 20 percent since the mid 1960's (Drezner et al., 1993:xiii). The results were not able to pinpoint a single factor that affected cost growth, but reasoned "the apparent consistency in cost growth could be

explained in terms of incomplete or incorrect implementation of the various cost control

and budgeting initiatives, due to strong institutional barriers" (Drezner et al., 1993:xiv).

Results also highlighted that "until later in this decade [1990-2000] we will not be able to

detect whether initiatives implemented as a result of the Packard Commission or the more

recent DMR have had the desired effect" (Drezner et al., 1993:50).

Searle Study

In 1997, empirical research by Searle studied the impact of the Packard

Commission on reducing cost overruns within major defense acquisition programs.

Searle analyzed contracts that were completed between 1 January 1988 and 31 December

1995 (Searle, 1997:45). Searle concluded that not only did contract cost overruns not

improve following the Packard Commission, but also they worsened in the years

following implementation (Searle, 1997:76). Specifically, Searle found that the

worsening effect was found on development contracts while production contracts

experienced no significant change as a result of the Packard Commission

recommendations (Searle, 1997:82). Searle's methodology and recommendations

motivated this study.

Coopers and Lybrand

In October 1997, Coopers and Lybrand conducted an opinion survey to see how

effective DoD programs were at implementing acquisition reform initiatives originated

through legislation or policy changes, at the contract level (Coopers and Lybrand,

1997:2). The researchers surveyed 10 defense contractors to assess implementation. The

survey covered 90 contracts valued at $17.4 billion (Coopers and Lybrand, 1997:3). In

the realm of costs, the survey respondents noted significant savings in elimination of

military specifications, commercial exemption to cost or pricing data and using an open systems approach (Coopers and Lybrand, 1997:15). The Coopers and Lybrand team concluded that "there is a strong empirical basis for demonstrating that significant progress has been made over the past four years in the implementation of acquisition reform in DoD contracts" (Coopers and Lybrand, 1997:7). This study attempts to determine if the Coopers and Lybrand assessment of "significant progress" is true from contract cost performance point of view.

Christensen and Templin Study

Christensen and Templin (2002) conducted an empirical study to determine if acquisition reform initiatives spurred by the Navy's A-12 program cancellation (1991) had impacted cost performance (Christensen and Templin, 2002:105). Christensen and Templin analyzed 240 defense contracts and found that the post A-12 time period (defined as those contracts which began after 31 December 1991) contracts experienced improved cost performance (Christensen and Templin, 2002:113-114). The study also suggested that "transitional" time period contracts (contracts started before reform events and finished after reform events) experience worse cost performance due to the turbulence experienced during change (Christensen and Templin, 2002:114).

Chapter Summary

Chapter 2 provided a review of the reform initiatives that the DoD has worked through over the past 32 years. This review is a fundamental building block of the Phase Two analysis for developing the timeline of acquisition reform events. Acquisition Reform is nothing new to the DoD. The difference today is a reduced budget, changed

military and defense environment, and new leadership. EVM is a well-established

management tool and the valuable cost variance information it provides on DoD contracts

will be utilized in this study. The prior research discussed in this chapter laid the

foundation for this research area, motivated the research objectives and clarified the

methodology employed in this study. Chapter 3 describes the methodology for studying

DoD contracts for the cost variance and "rule of thumb" analysis.

III. Methodology

Chapter Overview

This chapter explains the analysis process for this research effort. It begins with a description of the database and data used, and explains the phases of analysis conducted. Each phase is broken down into explanations of research design, population, variables studied, hypotheses tested and how the data was prepared for each analysis phase.

Data Collection

The data utilized for the analysis comes from the Defense Acquisition Executive Summary (DAES) system. The DAES was established in 1984 and serves as an internal Department of Defense (DoD) reporting document (AFMC Financial Management Handbook, 2001:38-12). The DAES serves two primary functions: to provide progress information to DoD leadership on Major Defense Acquisition Programs (MDAPs) and to provide the DoD acquisition community feedback (DAES Web:1; DoD 5000-2R, 2001:C7.15.3).

The DAES is maintained by the Office of the Under Secretary of Defense for Acquisition, Technology and Logistics (OUSD[AT&L]) and contains cost and schedule performance data on more than 500 contracts since the early 1970s (Christensen and Templin, 2000:197). The earned value management data used in this study is taken from the DAES database. This data is summarized from contractor Cost Performance Reports (CPR) by government program offices and deemed reliable by the contractor's requirements under the EVM system criteria described in Chapter 2 (Christensen and Templin, 2000:197; Christensen and Templin, 2002:108; Gordon, 1996:33-34). The

criteria "are internal controls intended to encourage adequate planning and control" (Christensen and Templin, 2002:108). The government deems the performance data reliable when the contractor is compliant with EVM system criteria (Christensen and Templin, 2002:108).

Data from the DAES used for this study is current as of June 2002. The DAES database contains multiple fields to describe each contract contained within the system. For the purposes of this study the following fields were used to prepare the data and perform the necessary calculations for the two phases of analysis:

- Submit Date – date the CPR data is submitted to OUSD[AT&L] for inclusion into the database.

- Actual Cost of Work Performed (ACWP) – cost incurred in accomplishing the work performed.

- Budgeted Cost of Work Performed (BCWP) – earned value, also the estimated cost of the work performed.

- Contract Budget Base (CBB) – the total of all negotiated cost of the contract.

- Management Reserve (MR) – contractor's contingency budget; part of CBB.

- Contract ID (CID) – identifies what service manages the contract.

- Contract Type (CTYPE) – identifies whether contract is cost plus, fixed price or some combination/hybrid.

- Program Phase (PPHASE) – identifies if contract is for production or development phase of program life cycle.

Phase One Analysis

<u>Research Design</u>

Chapter 2 detailed the history of acquisition reform and the timeline of the current acquisition reform initiatives. The Federal Acquisition Streamlining Act (FASA) of 1994

marked the congressional initiation of the reform effort for the DoD, however, within the department the reform effort was already under way. The assignment of Colleen Preston as the first Deputy Under Secretary of Defense for Acquisition Reform (DUSD[AR]) in June 1993, jump started DoD's reform initiatives (Munechika, 1997:31). By the start of fiscal year 1995, the DoD had complied with all applicable components of Title V of the FASA, those aimed at better cost control goals and implementation of those goals (GAO/NSIAD-97-22BR:2). This early headway and initial success was further evidenced by speeches of both the Kaminski in February 1997 and Gansler in March 1998 (Kaminski, 1997; Gansler, 1998).

This study will utilize a cut-off date of 31 December 1997. This date was selected for the following reasons:

- Passage of Clinger-Cohen Act of 1996 (late 1996), which mandated budget for training and education;

- DoD 5000 Series update released in 1997; and

- Speeches by Kaminski and Gansler regarding success to date in 1997 and 1998, respectively.

Consistent with the Searle study, this date is judgmentally selected (Searle, 1997:45). This delineation date also allows for four years of analysis, based on the June 2002 DAES database, on each side of the cut-off date for comparison of cost performance. This study will use statistical analysis to compare the before (1 January 1994 – 31 December 1997) population to the after (1 January 1998 – 31 December 2001) population to assess the impact of the current reform initiatives on cost performance.

Research Population

The previous sections laid the groundwork for defining the research population for Phase One. The first review of the database was to eliminate any contracts that did not have EVM data, both BCWP and ACWP, as cost performance cannot be assessed against contracts without this information (DSMC Gold Card, 2000). The pre-current reform period is defined as 1 January 1994 to 31 December 1997 and the post-current reform period is defined as 1 January 1998 to 31 December 2001. Only contracts that completed work during this eight year time period are included in this phase. Consistent with the Searle study in 1997, the database was further divided into either development or production phases (Searle, 1997:46). For this portion of Phase One analysis, any contract not indicating the phase was eliminated from a program phase comparison. The division scheme for program phase is defined in Table 11. Any contracts that were not identified by any of the terms in Table 11 were eliminated from the program phase comparison, as were contracts that contained multiple terms from both the production phase and development phase columns.

Table 11. Program Phase Division Identifiers

Production Phase	Development Phase
Production	Development
Ship Construct	Full Scale Development (FSD) or (FSED)
LRIP	Engineering & Manufacturing Development (EMD)
Procurement	Engineering Development
Prod and Deploy	Research Development (RDT&E)
Fabrication	DEV
PROD	Sys Dev

Similar to the program phase comparison, the data was divided by contract type, either cost plus or fixed price. This portion of the analysis is similar to the program

phase, but considers reform impact based on contract type. This research expects to see a

significant change for both contract types as all contracts were equally affected by the

FASA (see Chapter 2, Table 6) (DSMC FASA). Therefore, any contracts that did not

contain information on contract type, or contained a hybrid (e.g. FPI/AF/CPAF), were

excluded from this portion of the analysis.

<u>Completed Contract Defined</u>

The DAES database does not contain earned value data for all contracts at the

100% completion point (Searle 1997:47; Christensen and Templin, 2002:108). Prior

research indicates that at the 75% completion point, contract cost performance remains

relatively stable (Gordon, 1996:Ch 3; Searle, 1997:47;). Searle points out that "the

contract is nearly complete at this point [75% and greater] in terms of the costs incurred"

(Searle, 1997:47). This study defines completion in the same manner. The completed

contract cost data used in the analysis is the last report submittal date for contracts at 75%

or greater and meet the cut-off dates defined previously for pre- and post-reform time

periods.

The DAES database does not contain a field that defines percent completion.

This value must be calculated using the data available. Equations 1 and 2 are used to

calculate percent complete. The Contract Budget Base (CBB) contains the Budget at

Complete (BAC), which is the total cost of the planned work, and Management Reserve

(MR).   The percent complete simply relates the current amount of work complete, or

BCWP, to the total amount of work on the contract, represented by the BAC (DSMC

Gold Card, 2000).

$$BAC = CBB - MR \qquad (1)$$

$$\text{Percent Complete} = BCWP / BAC \qquad (2)$$

At this point, the database is ready for the necessary analysis to reduce it to the two

samples necessary for the Phase One analysis.

Sample Defined

The samples utilized for this study included all DAES database contract

information that meets all of the following requirements:

- Completion (75% or greater) as of the cut-off dates for pre- and post-acquisition reform periods

- Defined as either production or development (as defined in Table 11) for production and development program phase analysis

- Defined as either a Cost Plus or Fixed Price contract type for contract type analysis

Table 12 provides statistics on the samples available from the DAES database meeting all

the listed requirements and used for this study. The numbers represent number of

contracts utilized in each period and portion of the analysis.

Table 12. Study Sample Statistics

Group	Pre-Reform	Post-Reform
	(1 Jan 94 - 31 Dec 97)	(1 Jan 98 - 31 Dec 01)
All DoD contracts	109	95
Program Phase		
Production	61	34
Development	36	44
Contract Type		
Cost Plus	40	60
Fixed Price	59	29

The analysis uses all contracts for each part of the Phase One analysis. For example, comparing all contracts, 109 pre-reform completed contracts are compared against 95 post-reform completed contracts. For the program phase portion of the analysis, 10 of the 109 pre-reform contracts and 17 of the 95 post-reform contracts are removed because all 27 of the excluded contracts do not contain distinct (Table 11) program phase information. For the contract type portion of the analysis, 10 of the 109 pre-reform contracts and 6 of the 95 post-reform contracts are excluded because all 16 of the excluded contracts do not contain specific contract type information. In these cases, either there is no contract type data or the contract type is a fixed price/cost plus hybrid.

  Research Variable

   This study is concerned with analyzing the impact of acquisition reform on cost performance. The final overrun (FO) of each sample contract is calculated with Equation 3. This equation takes the actual cost of work performed (ACWP) data and compares it to the budgeted cost of work performed (BCWP). Both the ACWP and the BCWP values used in this analysis are the final reported values for all sample contracts.

$$FO = ACWP - BCWP \qquad (3)$$

As a result of the equation used for this analysis, all overruns will compute as a positive number, which is contrary to how overruns are reported in the EVM system and associated reports. This is important to note for understanding the results of the hypotheses testing and for Phase Two analysis. Therefore, a negative FO value would indicate a cost underrun for the completed contract in the sample.

The comparison of final overruns or underruns does, however, have one problem. A larger dollar value contract would overshadow performance on a smaller dollar value contract. Therefore, the data must be normalized in order to do conduct a reliable comparison. This adjustment calculates the final overrun percentage (FO%), as this statistic will have the same meaning regardless of the size of the contract studied. Equation 4 illustrates how this is computed. As noted previously, a negative percentage indicates a final underrun percentage. The use of the final overrun percentage equation takes the final overrun, as calculated in Equation 3, and divides this value by the BCWP.

$$FO\% = \text{Final Overrun (FO)} / \text{BCWP} \qquad (4)$$

To perform the comparison of the cost performance for the pre- and post-reform population samples, this study uses the mean FO% of each sample as the study parameter. This is computed using the equation given in Equation 5 (Searle, 1997:51).

$$\overline{FO\%} = \left(\sum_{1}^{n} FO\% \right) / n \qquad (5)$$

i = the ith contract in population
n = total number of contracts in population

Research Question and Hypotheses

Research question: Did the current acquisition reform initiatives have an effect on contract cost performance? To answer this question, the following five hypotheses are tested:

Hypothesis 1: Is the mean FO% for all DoD pre-reform (1 January 1994 –

31 December 1997) contracts different than the mean FO% for all DoD post-reform

(1 January 1998 – 31 December 2001) contracts?

H_o: mean FO%$_{\text{pre-reform}}$ = mean FO%$_{\text{post-reform}}$
H_a: mean FO%$_{\text{pre-reform}}$ ≠ mean FO%$_{\text{post-reform}}$

If the null hypothesis is true, this would indicate that the current reform period did not

have a significant impact on cost performance. If the alternate hypothesis is true, this

would indicate the opposite, that the current reform period did have a significant impact

on cost performance.

Hypotheses 2 and 3: Is the mean FO% for DoD pre-reform (1 January 1994 –

31 December 1997) contracts different than the mean FO% for DoD post-reform

(1 January 1998 – 31 December 2001) contracts in the development or production phase?

H_o: mean FO%$_{\text{pre-reform (development phase)}}$ = mean FO%$_{\text{post-reform (development phase)}}$
H_a: mean FO%$_{\text{pre-reform (development phase)}}$ ≠ mean FO%$_{\text{post-reform (development phase)}}$

H_o: mean FO%$_{\text{pre-reform (production phase)}}$ = mean FO%$_{\text{post-reform (production phase)}}$
H_a: mean FO%$_{\text{pre-reform (production phase)}}$ ≠ mean FO%$_{\text{post-reform (production phase)}}$

If the null hypothesis is true, this would indicate that the current reform period did not

have a significant impact on cost performance for development or production contracts,

respectively. If the alternate hypothesis is true, this would indicate the opposite, that the

current reform period did have a significant impact on cost performance for development

or production contracts, respectively.

.*Hypotheses 4 and 5:* Is the mean FO% for DoD pre-reform (1 January 1994 –

31 December 1997) contracts different than the mean FO% for DoD post-reform

(1 January 1998 – 31 December 2001) contracts based on contract type (cost plus and

fixed price)?

H_o: mean FO%$_{\text{pre-reform (cost plus contracts)}}$ = mean FO%$_{\text{post-reform (cost plus contracts)}}$
H_a: mean FO%$_{\text{pre-reform (cost plus contracts)}}$ ≠ mean FO%$_{\text{post-reform (cost plus contracts)}}$

H_o: mean FO%$_{\text{pre-reform (fixed price contracts)}}$ = mean FO%$_{\text{post-reform (fixed price contracts)}}$
H_a: mean FO%$_{\text{pre-reform (fixed price contracts)}}$ ≠ mean FO%$_{\text{post-reform (fixed price contracts)}}$

If the null hypothesis is true, this would indicate that the current reform period did

not have a significant impact on cost performance for cost plus or fixed price contracts,

respectively. If the alternate hypothesis is true, this would indicate the opposite, that the

current reform period did have a significant impact on cost performance for cost plus or

fixed price contracts, respectively.

Statistical Analysis

The Phase One analysis hypotheses all involve comparing mean values and

testing to see if they are statistically similar or different. The first step in conducting the

tests is to decide whether to use a parametric or nonparametric test. Parametric tests

make specific assumptions with regard to the population parameters that characterize the

underlying distributions for which the test is employed (Sheskin, 2000:33).

Nonparametric tests make no assumptions about the population parameters (Sheskin,

2000:33).

The t-test for two independent samples involves using the two sample means to

estimate the values of the means of the populations from which they come (Sheskin,

2000:247). If the result of the t-test is significant, the conclusion will be that "there is a

high likelihood that the samples represent populations with different means" (Sheskin,

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2000:247). The following assumptions regarding the sample data must be met to use the

two-sample t-test: the sample data has been randomly selected from the population and

the populations are independent of each other; the population data comes from a normal

distribution; and the populations must have the same variance (Sheskin, 2000:247).

Should any of the assumptions required for use of the t-test be violated, it is possible that

any results generated from conducting the two-sample t-test may be inaccurate or

compromised (Sheskin 2000:247).

The analogous nonparametric test to the two-sample t-test is the Mann-Whitney U

test; useful when the normality assumption is violated (Devore, 2000:659; Searle,

1997:55; Sheskin, 2000:269). Research has shown that the Mann-Whitney U test

provides a powerful test option when the normality assumption has been violated

(Sheskin, 2000:297). Many statisticians consider the Mann-Whitney U test the best

nonparametric test for location (Gibbons, 1971:149; Searle, 1997:56). The Mann-

Whitney U test is 95% as efficient in discerning significant population differences

compared to the two-sample t-test when the normality assumption is met, but is over

100% as efficient in doing the same when the normality assumption is not met (Sheskin,

2000:297).

Empirical evidence shows that the two-sample t-test is reasonably robust,

meaning it provides reliable information about the underlying sampling distribution,

despite violation of any of the assumptions (Sheskin, 2000:269). Researchers argue that

parametric tests, the two-sample t-test in particular, are more powerful than their

analogous nonparametric tests (Sheskin, 2000:270). Previous research shows that cost

variances are not normally distributed; therefore, both the two-sample t-test and the

Mann-Whitney U test will be used to ensure completeness (Christensen and Templin, 2002:108).

For all hypothesis testing, a significance level (alpha value [α]) of .05 will be used. The results will be presented with the appropriate test statistic value, but will be explained using p-values. The p-value is the smallest level of significance at which the null hypothesis (H_o) would be rejected when a specified test procedure is used (Devore, 2000:342). The p-value is then compared against the alpha level (.05) to either accept or reject the null hypothesis (Devore, 2000:342). Table 13 displays the acceptance and rejection criteria for the tests using p-values (Devore, 2000:342). The smaller the p-value, the more contradictory is the data to the null hypothesis (Devore, 2000:342). The benefit of p-values is that they convey information about the strength of evidence against the null hypothesis (H_o) and allow a decision maker to draw conclusions at any specified level of significance (α) (Devore, 2000:340).

Table 13. Hypothesis Test Decision Table

P-value $\leq$ .05 $\Rightarrow$ reject H_0 at level .05
P-value > .05 $\Rightarrow$ do not reject H_0 at level .05

Data Preparation

Prior to conducting hypothesis testing, the assumptions of the two-sample t-test and the Mann-Whitney U test will be determined. The sample data must be analyzed to assess independence, randomness, normality and constant variance (two-sample t-test only). The purpose of this assessment is to determine beforehand which testing method is most appropriate to aid in interpreting the results in Chapter 4.

Independence

In the Searle study (1997), independence was assumed based on the following:

- Likeness caused by legislation and regulation would affect cost performance equally across all DoD contracts; and

- Multiple contracts under similar program managers are run by a multitude of cost management contractors and personnel (Searle, 1997:58-59).

The characteristics of the populations utilized in this study, and their respective samples, are the same. All DoD contracts are managed under the same legislation and regulations. In fact, the point of this study to see if changes to the legislation and regulations impacted cost performance by comparing pre- and post-reform populations. Within each population, there are a multitude of support contractors and financial management personnel, with varying degrees of experience and training, performing cost management activities. For these reasons, independence of the populations can be assumed. However, it is important to acknowledge the possibility that the samples do not satisfy the independence requirement, which could invalidate the results of the analysis.

Random Sample

Random sample is defined as "one for which any particular subset of the specified size has the same chance of being selected" (Devore, 2000:8). In this study, all applicable population data contained in the DAES database is used in the analysis. However, because "applicable data" contains contracts that have all the necessary EVM data reported, the sample cannot be true random samples. The population samples contain all available data points contained in the DAES database, therefore, the random sample requirement is assumed. However, it is critical to note that without the random sample assumption satisfied, the results of this study would be questionable.

Normality and Equality of Variance

Normality will be tested both subjectively and objectively. The subjective

assessment will consist of normal probability plots. According to D'Agostino and

Stephens, normal probability plotting should always accompany a formal test of

normality (D'Agostino and Stephens, 1986:405). A straight line would indicate the

existence of an underlying normal distribution for the sample data (D'Agostino and

Stephens, 1986:35). The graphical representation serves only as an informal preliminary

judgment of normality and supports formal numerical techniques (D'Agostino and

Stephens, 1986:41).

The Shapiro-Wilk test for normality will serve as the objective assessment. The

Shapiro-Wilk test is a powerful non-graphical test for the assumption of normality

(D'Agostino and Stephens, 1986:406; Searle, 1997:60; Verrill, 1981:3). The Shapiro-

Wilk test p-value will also indicate the significance of any violations of the normality

assumption. The null hypothesis of this test is that the data comes from a normal

distribution (Searle, 1997:66; White, 2002). Therefore, any p-values less than or equal to

.05 would indicate a non-normal distribution.

The test for equal variances involves a hypothesis test using the F distribution

(Devore, 2000:393). The null hypothesis is that the population variances are equal. The

test statistic is computed using the ratio of the sample variances (Devore, 2000:393;

Searle, 1997:60). Again, the p-value will be used to assess either the acceptance or

rejection of the equal variance null hypothesis, with a significance level of .05. The

Levene Test for Equality of Variances is used in this study because this test is less

sensitive to departures from normality (Neter, Kutner, Nachtsheim, and Wasserman,

1996:112; NIST/SEMATECH, 2003). This is important as prior research indicates that cost variance data tends to be non-normally distributed (Christensen and Templin, 2002:108). The results of the Levene Test will dictate the specific t test employed for the parametric hypothesis testing. If the test indicates equal variances, the pooled t test will be selected as this outperforms the two-sample t test by reducing the probability of rejecting the null hypothesis when null hypothesis is true (Devore, 2000:370). Conversely, when the Levene test results indicate unequal variances, the standard two-sample t test procedures will be selected as the pooled t test can lead to erroneous conclusions if applied when the variances are different (Devore, 2000:370).

Phase One Summary

This section detailed the Phase One analysis methodology. The treatment date and study populations and samples were defined, research variable and hypotheses explained, and methods of testing detailed. The tests of assumptions are conducted to indicate which test method is most appropriate. For all hypotheses, both the parametric two-sample t-test and nonparametric Mann-Whitney U test will be utilized for completeness.

Phase Two Analysis

Research Design

The second phase of analysis is focused on discovering the existence of any trends or time lags between acquisition reform initiatives and cost performance changes, either positive or negative. This phase does not include statistical tests, but simply plots the cost performance of all active contracts over the time period provided in the DAES

database and determines if consistent trends or time lags exist in an effort to develop a "rule of thumb". The research conducted for Chapter 2 of this report provides sufficient information to develop a timeline of acquisition reform initiatives, starting with Packard in 1970 and concluding with the Clinger-Cohen Act in 1996. The DAES database contains earned value data for contracts from 1970 to June 2002 for the cost performance assessment.

Research Population and Sample

The research population consists of all contracts reported in the DAES database. The sample selected from the population includes all contracts that provide earned value data. Any contract with incomplete earned value data was eliminated from this analysis because cost performance cannot be assessed. The analysis used all available contracts because all contracts are managed under the same regulations and legislation and the DoD and Congress are concerned with all DoD contracts, not solely with any particular service.

Similar to Phase One, the analysis will also look at program phase and contract type to see if reform initiatives affect these contracts differently. The division scheme utilized is exactly the same as performed in phase one. Any contracts from the "all contracts" sample explained in the prior paragraph that did not contain information on specific program phase (Table 11) or specific contract type (either fixed price or cost plus) were eliminated from this portion of the phase two analysis.

Research Variable

Phase Two analysis focused on cost performance over time by looking at DoD's overall contract cost performance at snapshots over time. The snapshots are determined

by the DAES submittal dates as reported in the DAES database. For each submittal date, the mean ACWP and BCWP are calculated. Equation 6 illustrates how these are calculated. The mean ACWP and mean BCWP are used to account for the inconsistent number of contracts reported in different submittal periods, as well as adjust for periods when larger contracts and/or smaller contracts are reported (same for Phase One). These calculations also give values for the average amount of work completed to date compared against the average cost of the same work. Utilizing the mean helps eliminate spikes caused by a period of larger contracts or a period of smaller contracts and provides a measure of the center for the ACWP and BCWP (Makridakis, Wheelwright, and Hyndman, 1998:29).

$$\overline{ACWP_j} = \left(\sum_1^n ACWP_i \right) / n \qquad (6)$$

i = the ith submittal in month j
n = total number of submittals in month j

The variable used in this analysis phase is the mean cost overrun percentage for each year. Equations 7, 8, and 9 illustrate the necessary calculations. This mean accounts for differences in reporting from year to year and provides a measure of the center of the data (Makridakis, Wheelwright, and Hyndman, 1998:29). In the DAES database, some years have eleven months of reporting, while other years have four. Similar to the interim calculation in Equation 6, this averaging smoothes out any monthly spikes caused by the inconsistent reporting contained in the database. Again, it also provides values for the average amount of work completed (mean BCWP) compared

against the average cost of that work (mean ACWP). The mean cost overrun percentage is calculated as a positive number for overruns and a negative number for underruns; the same procedure used in Phase One. This method was selected for the appearance of the time plots.

$$\overline{ACWP_k} = \left(\sum_1^m \overline{ACWP_j} \right) / m \qquad (7)$$

j = the jth monthly submittal in year k
m = total number of monthly submittals in year k

$$\overline{CO_k} = \overline{ACWP_k} - \overline{BCWP_k} \qquad (8)$$

$$\overline{CO\%_k} = \overline{CO_k} / \overline{BCWP_k} \qquad (9)$$

k = the kth year of DAES reporting

Trend Versus Timeline Analysis

The most obvious graphical form for time series data is the time plot in which the data are plotted over time (Makridakis, Wheelwright, and Hyndman, 1998:24). A time plot will reveal any trends over time (Chatfield, 1996:11; Makridakis, Wheelwright, and Hyndman, 1998:24). The goal is to see if a "rule of thumb" can be determined based on visually examining cost performance over time against the backdrop of acquisition reform initiative implementation.

A forecasting concept that is useful in describing any noted trends is intervention analysis. Interventions are one-time events that have an impact on a variable (mean cost overrun %) (Makridakis, Wheelwright, and Hyndman, 1998:418). The intervention is assumed to occur at one time period only, but the impact can be instantaneous or spread

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over time (Makridakis, Wheelwright, and Hyndman, 1998:418). Acquisition reform

initiatives represent interventions; either of DoD leadership, Congress, or both, to impact

the way the defense community acquires weapon systems. There are four types of

interventions that will be considered in this analysis. They are step-based interventions,

pulse-based interventions, decayed response interventions, and delayed response

interventions (Makridakis, Wheelwright, and Hyndman, 1998:419-422). Figure 5

graphically shows what each of these interventions might look like (Makridakis,

Wheelwright, and Hyndman, 1998:420).
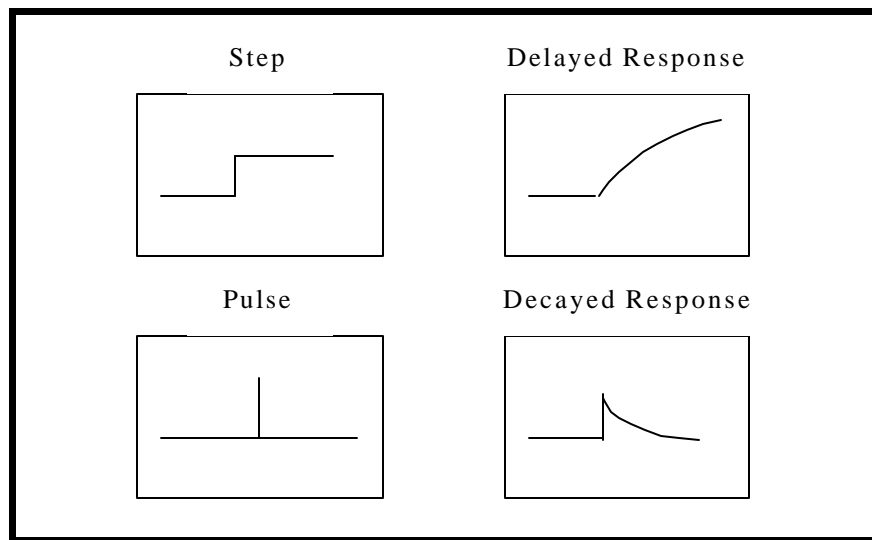
Figure 5. Intervention Graphical Representation

Step-based interventions are where there is a sudden and lasting drop or rise in the

variable (Makridakis, Wheelwright, and Hyndman, 1998:419). A pulse-based

intervention affects the variable at the point of intervention but nowhere else

(Makridakis, Wheelwright, and Hyndman, 1998:422). A decayed response intervention

has an immediate impact but then decays away slowly (Makridakis, Wheelwright, and

Hyndman, 1998:422). Delayed-response interventions will cause a rise or fall in the

variable, but not instantaneously (Makridakis, Wheelwright, and Hyndman, 1998:421).

The goal in this analysis will be to determine if there is a common intervention

description for acquisition reform initiatives and the time period associated with the

impact.

<u>Phase Two Summary</u>

Phase Two analysis is focused on analyzing the cost performance of DoD

contracts, in total, by phase and contract type. This will be accomplished with the use to

time plots of the mean cost overrun percentage versus time (1970 – 2002). The goal is to

identify any existence of trends between acquisition reform initiatives and cost

performance change. The goal is also to place a time period with any consistent pattern

of intervention impact.

Phase Three Analysis

Phase Three analysis will only be conducted if results from Phase One and Phase

Two indicate a new treatment date for hypothesis testing should be considered. The

hypotheses tested and hypothesis testing procedures would be identical to Phase One.

The only differences would be in population and sample for pre- and post-reform periods.

Statistics regarding the samples and treatment date selected will be represented in

Chapter 4, if Phase Three becomes necessary.

Chapter Summary

This chapter explained the methodology employed to conduct the phases of

analysis. Phases One and Three focus on conducting hypothesis tests on pre-reform and

post-reform contracts to see if there is a significant difference in cost performance. Phase

Two focuses on visually analyzing DoD contract cost performance over time to identify any trends and time lags between the implementation of acquisition reform initiatives and cost performance changes. Chapter 4 provides the analysis results.

IV. Results

Chapter Overview

This chapter presents the results of the phase analyses. The results of all statistical tests and graphical analysis are presented by each individual phase.

Phase One

The purpose of Phase One was to test to see if a difference existed between pre-reform contracts and post-reform contracts by performing hypothesis tests of the mean final cost overrun percentage of each sample. The treatment date used for Phase One was 31 December 1997. The analysis consisted of five hypothesis tests; one test for all contracts, one for fixed price contracts, one for cost plus contracts, one for production phase contracts, and one for development phase contracts. Table 12 provides data on the number of contracts used in each hypothesis test. The Phase One results are separated by each applicable hypothesis test.

Prior to any hypothesis testing of the means, the samples were tested to determine which hypothesis testing method, either parametric or non-parametric, was more appropriate. If a sample appears to be normally distributed, then that sample is tested to assess constant variance. Both assumptions are essential for the two-sample t-test. Regardless of the assumption test results, both the parametric (two-sample t-test) and non-parametric (Mann-Whitney U Test) are used. The assumption test results simply give credence to which mean hypothesis testing method is more credible. All normal probability plots are found in Appendix B and the Shapiro-Wilk test values are found in each test results section.

A statistical software package, JMP 4.0, calculated all statistical test values used in this study. The software uses the non-parametric Wilcoxon-Mann-Whitney test for testing the means. The Mann-Whitney test is equivalent to the Wilcoxon-Mann-Whitney (a.k.a. the Wilcoxon Rank-Sum test) used by the JMP 4.0 software (Devore, 2000:659; Gibbons, 1985:148; Sheskin, 2000:313). The p-values are the same for both tests.

The results for the two-sample t test are listed for each test. In cases where the Levene test for equal variances indicates that the variances are not equal, the Welch ANOVA test p-value is used. The Welch ANOVA is equivalent to the unequal variance two-sample t test when comparing two sample means (JMP 4.0, 2001). Conversely, when the Levene Test indicates that the variances are equal, the equal variance two-sample t test (pooled t procedure) p-value is used.

Hypothesis Test #1 – All DoD

The first hypothesis tested to determine if the mean final cost overrun percentage (FO%) of all pre-reform contracts (1 Jan 94 – 31 Dec 97) is significantly different than the mean FO% of all post-reform contracts (1 Jan 98 – 31 Dec 01).

Normality and Equal Variance Test Results

The Shapiro-Wilk test conducted on the pre-reform sample produced a test statistic value of .8119 and a p-value of .0000. These values indicate a non-normal distribution for the pre-reform sample. The Shapiro-Wilk test conducted on the post-reform sample produced a test statistic value of .6675 and a p-value of .0000. These values indicate a non-normal distribution for the post-reform sample. At a significance level of .05, both results indicate both samples are non-normal; therefore more emphasis will be placed on the Mann-Whitney test results over the two-sample t-test.

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The Levene test for equal variances produced a test statistic value of 2.9127 and a p-value of .0894. This result indicates that the population variances are equal at a significance level of .05. Therefore, the pooled t test results will be utilized in the analysis.

Hypothesis Test Results

The results of the hypothesis test are represented in Table 14. The test statistic values and associated p-values are consistent. At a significance level of .05, the results indicate that the null hypothesis is not rejected.

Table 14. Phase One – Hypothesis Test #1 Results

All DoD contracts		
	Pre-Reform	Post-Reform
Mean FO%	8.2522	6.2478
Std Error	1.399	1.498
Test Results	**Mann-Whitney**	**Two-Sample t**
Test Statistic (Ws)	9309.5	-0.978
P-value	0.3094	0.3293

The Mann-Whitney results indicate that the two sample distributions do not differ in location and the two-sample t-test indicates the mean FO% for each sample is not significantly different. Both results suggest that the mean FO% of the pre-reform sample is equal to the mean FO% of the post-reform sample.

Hypothesis Test #2 – Development Phase

The first hypothesis tested to determine if the mean final cost overrun percentage (FO%) of pre-reform development phase contracts (1 Jan 94 – 31 Dec 97) is significantly different than the mean FO% of post-reform development phase contracts (1 Jan 98 – 31 Dec 01).

The Shapiro-Wilk test conducted on the pre-reform sample produced a test statistic value of .8833 and a p-value of .0010. These values indicate a non-normal distribution for the pre-reform sample. The Shapiro-Wilk test conducted on the post-reform sample produced a test statistic value of .8506 and a p-value of less than .0001. These values indicate a non-normal distribution for the post-reform sample. At a significance level of .05, both results indicate both samples are non-normal, therefore more emphasis will be placed on the Mann-Whitney test results over the two-sample t-test.

The Levene test for equal variances produced a test statistic value of 12.5972 and a p-value of .0007. This result indicates that the population variances are not equal at a significance level of .05. Therefore, the Welch ANOVA test results will be utilized in the analysis.

Hypothesis Test Results

The results of the hypothesis test are represented in Table 15. The test statistic values and associated p-values are consistent. At a significance level of .05, the results indicate that the null hypothesis is not rejected.

Table 15. Phase One – Hypothesis Test #2 Results

Development Phase		
	Pre-Reform	Post-Reform
Mean FO%	11.0208	7.0911
Std Error	2.134	1.93
Test Results	**Mann-Whitney**	**Two-Sample t**
Test Statistic (Ws)	1503.5	-1.366
P-value	0.6634	0.176

The Mann-Whitney results indicate that the two sample distributions do not differ in location and the two-sample t-test indicates the mean FO% for each sample is not significantly different. Both results suggest that the mean FO% of the pre-reform sample is equal to the mean FO% of the post-reform sample.

Hypothesis Test #3 – Production Phase

The third hypothesis tested to determine if the mean final cost overrun percentage (FO%) of pre-reform production phase contracts (1 Jan 94 – 31 Dec 97) is significantly different than the mean FO% of post-reform production phase contracts (1 Jan 98 – 31 Dec 01).

Normality and Equal Variance Test Results

The Shapiro-Wilk test conducted on the pre-reform sample produced a test statistic value of .7144 and a p-value of less than .0001. These values indicate a non-normal distribution for the pre-reform sample. The Shapiro-Wilk test conducted on the post-reform sample produced a test statistic value of .6022 and a p-value of less than .0001. These values indicate a non-normal distribution for the post-reform sample. At a significance level of .05, both results indicate both samples are non-normal; therefore more emphasis will be placed on the Mann-Whitney test results over the two-sample t-test.

The Levene test for equal variances produced a test statistic value of .5688 and a p-value of .4527. This result indicates that the population variances are equal at a significance level of .05. Therefore, the pooled t test results will be utilized in the analysis.

The results of the hypothesis test are represented in Table 16. The test statistic values and associated p-values are consistent. At a significance level of .05, the results indicate that the null hypothesis is not rejected.

Table 16. Phase One – Hypothesis Test #3 Results

Production Phase		
	Pre-Reform	Post-Reform
Mean FO%	8.1880	6.7682
Std Error	2.216	2.968
Test Results	**Mann-Whitney**	**Two-Sample t**
Test Statistic (Ws)	1407	-0.383
P-value	0.0814	0.7023

The Mann-Whitney results indicate that the two sample distributions do not differ in location and the two-sample t-test indicates the mean FO% for each sample is not significantly different. Both results suggest that the mean FO% of the pre-reform sample is equal to the mean FO% of the post-reform sample for production phase contracts.

Hypothesis Test #4 – Cost Plus Contracts

The fourth hypothesis tested to determine if the mean final cost overrun percentage (FO%) of cost-plus pre-reform contracts (1 Jan 94 – 31 Dec 97) is significantly different than the mean FO% of cost-plus post-reform contracts (1 Jan 98 – 31 Dec 01).

Normality and Equal Variance Test Results

The Shapiro-Wilk test conducted on the pre-reform sample produced a test statistic value of .8454 and a p-value of less than .0001. These values indicate a non-normal distribution for the pre-reform sample. The Shapiro-Wilk test conducted on the

post-reform sample produced a test statistic value of .8461 and a p-value of less than .0001. These values indicate a non-normal distribution for the post-reform sample. At a significance level of .05, both results indicate both samples are non-normal, therefore more emphasis will be placed on the Mann-Whitney test results over the two-sample t-test.

The Levene test for equal variances produced a test statistic value of 7.2882 and a p-value of .0082. This result indicates that the population variances are not equal at a significance level of .05. Therefore, the Welch ANOVA test results will be utilized in the analysis.

Hypothesis Test Results

The results of the hypothesis test are represented in Table 17. The test statistic values and associated p-values are consistent. At a significance level of .05, the results indicate that the null hypothesis is not rejected.

Table 17. Phase One – Hypothesis Test #4 Results

Cost Plus Contracts		
	Pre-Reform	Post-Reform
Mean FO%	5.1422	5.5138
Std Error	1.739	1.420
Test Results	**Mann-Whitney**	**Two-Sample t**
Test Statistic (Ws)	1820.5	0.165
P-value	0.1614	0.8689

The Mann-Whitney results indicate that the two sample distributions do not differ in location and the two-sample t-test indicates the mean FO% for each sample is not significantly different. Both results suggest that the mean FO% of the pre-reform sample is equal to the mean FO% of the post-reform sample for cost plus contracts.

<u>Hypothesis Test #5 – Fixed Price Contracts</u>

The fifth hypothesis tested to determine if the mean final cost overrun percentage (FO%) of fixed price pre-reform contracts (1 Jan 94 – 31 Dec 97) is significantly different than the mean FO% of fixed price post-reform contracts (1 Jan 98 – 31 Dec 01).

Normality and Equal Variance Test Results

The Shapiro-Wilk test conducted on the pre-reform sample produced a test statistic value of .7921 and a p-value of less than .0001. These values indicate a non-normal distribution for the pre-reform sample. The Shapiro-Wilk test conducted on the post-reform sample produced a test statistic value of .6382 and a p-value of less than .0001. These values indicate a non-normal distribution for the post-reform sample. At a significance level of .05, both results indicate both samples are non-normal, therefore more emphasis will be placed on the Mann-Whitney test results over the two-sample t-test.

The Levene test for equal variances produced a test statistic value of 2.2736 and a p-value of .1353. This result indicates that the population variances are equal at a significance level of .05. Therefore, the pooled t test results will be utilized in the analysis.

Hypothesis Test Results

The results of the hypothesis test are represented in Table 18. The test statistic values and associated p-values are consistent. At a significance level of .05, the results indicate that the null hypothesis is not rejected.

Table 18. Phase One – Hypothesis Test #5 Results

Fixed Price Contracts		
	Pre-Reform	Post-Reform
Mean FO%	8.6052	8.4414
Std Error	2.156	3.075
Test Results	**Mann-Whitney**	**Two-Sample t**
Test Statistic (Ws)	1120	-0.044
P-value	0.1313	0.9653

The Mann-Whitney results indicate that the two sample distributions do not differ in location and the two-sample t-test indicates the mean FO% for each sample is not significantly different. Both results suggest that the mean FO% of the pre-reform sample is equal to the mean FO% of the post-reform sample for fixed price contracts.

Sensitivity Testing

Prior research indicates that over target baseline contracts may not be reliable data points for the hypothesis testing. Over target baseline (OTB) contracts are contracts where the Total Allocated Budget (TAB) is greater than the Contract Budget Base (CBB), which is evidence that a contract's performance measurement baseline exceeds the project targets and therefore is unstable (Gordon, 1996:3). To test the sensitivity of the Phase One results, all OTB contracts were removed from the samples and the hypothesis tests were performed on the reduced samples. Table 19 displays the new sample sizes by removing the OTB contracts. The number of OTB contracts removed is in parentheses.

The test statistic values and associated p-values are found in Appendix C. All test values indicate no significant differences noted when removing the OTB contracts. In all cases, the null hypotheses were not rejected at a significance level of .05.

Table 19. Phase One Samples (OTB Removed)

Group	Pre-Reform	Post-Reform
	(1 Jan 94 - 31 Dec 97)	(1 Jan 98 - 31 Dec 01)
All DoD contracts	75 (34)	75 (20)
Program Phase		
Production	38 (23)	26 (8)
Development	25 (11)	35 (9)
Contract Type		
Cost Plus	32 (8)	47 (13)
Fixed Price	34 (25)	22 (7)

Christensen and Templin discovered in their research that transitional contracts tend to experience poor cost performance (Christensen and Templin, 2002:114). Transitional contracts are defined as those contracts that start before the treatment date and end after the treatment date. To test for the sensitivity of transitional contracts, the two samples used in the original hypothesis testing are separated into three samples; pre-reform, transitional, and post-reform. Pre-reform is the same as previously described in Chapter 3. Transitional contracts are those which started prior to 31 December 97 and finished before 31 December 01, while post-reform contracts are those that started after 31 December 97 and finished before 31 December 01. Table 20 displays the sample size numbers for the three samples for each respective hypothesis test. The samples were tested with and without the OTB contracts for robustness.

In order to test for a difference in the three samples the use of different hypothesis testing procedures is required. The parametric test employed is the single-factor analysis of variance (ANOVA). The ANOVA test utilizes the F-distribution and similar assumptions apply as did for the two-sample t test; normally distributed and equal variance of the samples. As noted in all two-sample testing, the samples are not normally

distributed, but the ANOVA test is conducted and reported for robustness. The non-parametric test used is the extension of the Mann-Whitney and Wilcoxon test for independent samples; the Kruskal-Wallis test (Gibbons, 1985:317). Both procedures test to see if any of the means are different (Devore, 2000:403-404; Gibbons, 1985:317)

The resultant test statistic and p-values are in Appendix C. The results indicate no significant difference between the means at a .05 significance (alpha) level.

Table 20. Phase One – Transitional Period Sensitivity Test Samples

Group	Pre-Reform	Transitional	Post-Reform
Contract Start	Prior to 31 Dec 1997	Prior to 31 Dec 1997	1 Jan 1998 or later
Contract Complete	Prior to 31 Dec 1997	1 Jan 1998 or later	1 Jan 1998 or later
All DoD contracts	109	86	9
Program Phase			
Production	61	30	4
Development	36	40	4
Contract Type			
Cost Plus	40	54	6
Fixed Price	59	24	5

Phase Two

The purpose of Phase Two was to analyze cost performance data over time to see any visible indications of acquisition reform initiative implementation and cost performance change. The analysis consisted of visually analyzing the plotted data to see any indications of change. The second part of the analysis is to apply the intervention concepts discussed in Chapter 3 to see if there is a common pattern exhibited between reform implementation and cost performance behavior.

<u>Trend vs. Timeline Visual Analysis</u>

The first step in this portion of the analysis involved setting up all the calculations explained in Chapter 3. This was all performed utilizing Microsoft Excel. The next step was to plot the values calculated from equation 9 against a timeline backdrop of acquisition reform initiatives. Figure 6 displays the graph for all contracts and Appendix D contains graphs for all DoD contracts broken out by program phase and contract type. The graph in Figure 6 displays a line for each service department (Air Force, Army, Navy) and a line for all DoD, which includes each service and any contracts that are not service-specific (e.g. Ballistic Missile Defense).
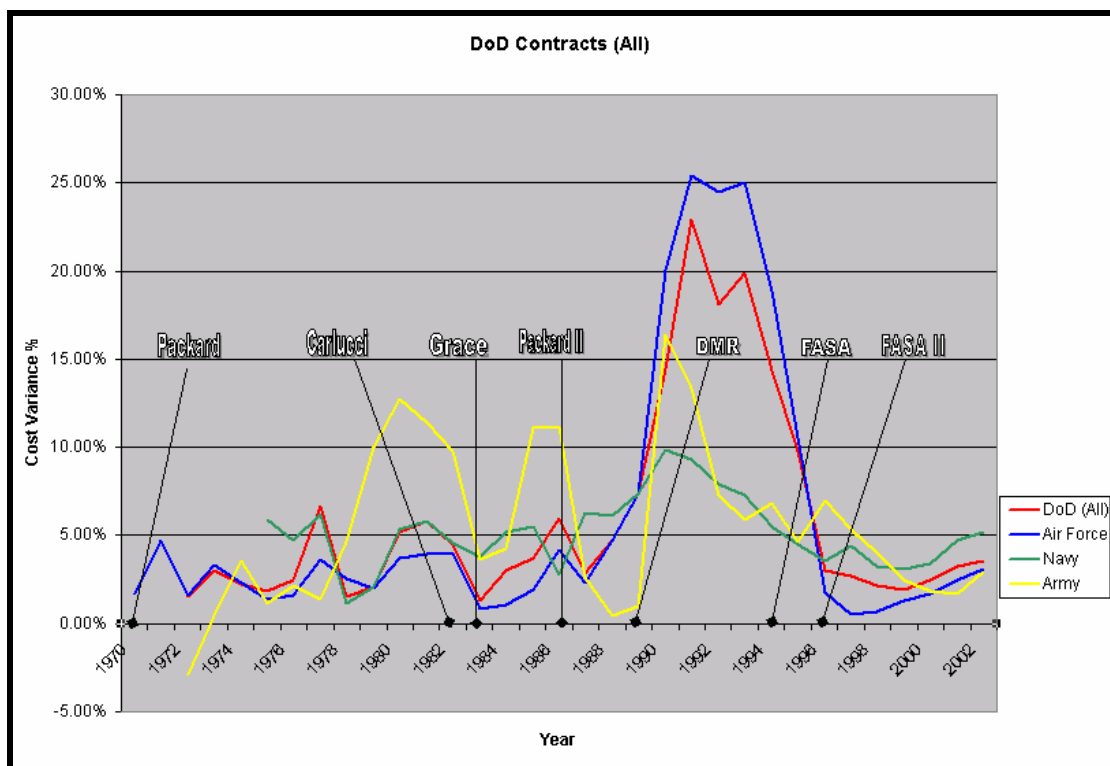
Figure 6. Phase Two Trend vs. Timeline Chart

This portion of the analysis highlights some noteworthy information. First, each service exhibits common cost variance trends over time. Each service data exhibits common

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peaks and valleys. This data behavior laid against the timeline provides a visual tool for assessment using the intervention analysis concepts.

Intervention Analysis

The most interesting behavior of the cost variance data is the sudden cost variance drops at or immediately following years where an acquisition reform report was issued or an initiative implemented. Utilizing the intervention concepts used in forecasting, this behavior seems to follow either a pulse intervention or a decayed-response intervention. The cost variance tends to immediately improve (better performance) following an acquisition reform event.   Following the Carlucci Initiatives in 1982, the DoD-All trend line takes a dip down to 1.32% in 1983. By 1986, the cost variance value is back to 6%. Following the Packard Commission in 1986, the cost variance value is 2.86% in 1987. By 1991, the cost variance is up to 22.93%, but on the heels of the Defense Management Report falls back to 14.4% in 1994. In 1996, two years after the Federal Acquisition Streamlining Act of 1994 and as the Clinger-Cohen Act of 1996 (FASA II) passes, the DoD cost variance value is down to 3.04%, and has not surpassed 4% since (as of June 2002).

The trend pattern exhibited in the data does give some potential to developing a rule of thumb. Certainly, something happened to the cost performance of active contracts during the different acquisition reform events laid out in the timeline. Further discussion of this relationship will occur in Chapter 5.

Phase Three

In consideration of the fact that Phase One determined that there was no significant difference between the pre-reform and post-reform contracts further analysis was conducted. As discussed in Chapter 3, Phase Three follows the same methodology as Phase One. Phase Three uses a treatment date of 31 December 1994. This treatment date was selected for the following three reasons:

- Deputy Undersecretary of Defense for Acquisition Reform position created in June 1993;

- GAO report stating DoD had complied with Title V of the FASA by Fiscal Year 1995 (Oct 1994); and

- Active contract cost variance dip discovered in Phase Two analysis.

Like Phase One, the pre-reform sample will consist of the four years before the treatment date and the post-reform period will consist of the four years following the treatment date. Table 21 provides information on the sample sizes for each portion of the analysis.

Table 21. Phase Three Sample Statistics

Group	Pre-Reform	Post-Reform
	(1 Jan 91 - 31 Dec 94)	(1 Jan 95 - 31 Dec 98)
All DoD contracts	156	116
Program Phase		
Production	97	52
Development	42	44
Contract Type		
Cost Plus	32	57
Fixed Price	114	46

<u>Hypothesis Test #1 – All DoD</u>

The first hypothesis tested to determine if the mean final cost overrun percentage (FO%) of all pre-reform contracts (1 Jan 91 – 31 Dec 94) is significantly different than the mean FO% of all post-reform contracts (1 Jan 95 – 31 Dec 98).

Normality and Equal Variance Test Results

The Shapiro-Wilk test conducted on the pre-reform sample produced a test statistic value of .7623 and a p-value of .0000. These values indicate a non-normal distribution for the pre-reform sample. The Shapiro-Wilk test conducted on the post-reform sample produced a test statistic value of .8108 and a p-value of .0000. These values indicate a non-normal distribution for the post-reform sample. At a significance level of .05, both results indicate both samples are non-normal; therefore more emphasis will be placed on the Mann-Whitney test results over the two-sample t-test.

The Levene test for equal variances produced a test statistic value of 1.0291 and a p-value of .3113. This result indicates that the population variances are equal at a significance level of .05. Therefore, the pooled t test results will be utilized in the analysis.

Hypothesis Test Results

The results of the hypothesis test are represented in Table 22. The test statistic values and associated p-values are consistent. At a significance level of .05, the results indicate that the null hypothesis is not rejected.

Table 22. Phase Three Hypothesis Test #1 Results

All DoD contracts		
	Pre-Reform	Post-Reform
Mean FO%	9.3375	7.4027
Std Error	1.333	1.546
Test Results	**Mann-Whitney**	**Two-Sample t**
Test Statistic (Ws)	15110	-0.948
P-value	0.2595	0.344

The Mann-Whitney results indicate that the two sample distributions do not differ in location and the two-sample t-test indicates the mean FO% for each sample is not significantly different. Both results suggest that the mean FO% of the pre-reform sample is equal to the mean FO% of the post-reform sample.

Hypothesis Test #2 – Development Phase

The first hypothesis tested to determine if the mean final cost overrun percentage (FO%) of pre-reform development phase contracts (1 Jan 91 – 31 Dec 94) is significantly different than the mean FO% of post-reform development phase contracts (1 Jan 95 – 31 Dec 98).

Normality and Equal Variance Test Results

The Shapiro-Wilk test conducted on the pre-reform sample produced a test statistic value of .7802 and a p-value of less than .0001. These values indicate a non-normal distribution for the pre-reform sample. The Shapiro-Wilk test conducted on the post-reform sample produced a test statistic value of .8834 and a p-value of .0002. These values indicate a non-normal distribution for the post-reform sample. At a significance level of .05, both results indicate both samples are non-normal, therefore more emphasis will be placed on the Mann-Whitney test results over the two-sample t-test.

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The Levene test for equal variances produced a test statistic value of .0212 and a p-value of .8846. This result indicates that the population variances are equal at a significance level of .05. Therefore, the pooled t test results will be utilized in the analysis.

Hypothesis Test Results

The results of the hypothesis test are represented in Table 23. The test statistic values and associated p-values are consistent. At a significance level of .05, the results indicate that the null hypothesis is not rejected.

Table 23. Phase Three – Hypothesis Test #2 Results

Development Phase		
	Pre-Reform	Post-Reform
Mean FO%	12.0255	10.7675
Std Error	2.460	2.403
Test Results	**Mann-Whitney**	**Two-Sample t**
Test Statistic (Ws)	1841.5	-0.366
P-value	0.9037	0.7154

The Mann-Whitney results indicate that the two sample distributions do not differ in location and the two-sample t-test indicates the mean FO% for each sample is not significantly different. Both results suggest that the mean FO% of the pre-reform sample is equal to the mean FO% of the post-reform sample.

Hypothesis Test #3 – Production Phase

The third hypothesis tested to determine if the mean final cost overrun percentage (FO%) of pre-reform production phase contracts (1 Jan 91 – 31 Dec 94) is significantly different than the mean FO% of post-reform production phase contracts (1 Jan 95 – 31 Dec 98).

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Normality and Equal Variance Test Results

The Shapiro-Wilk test conducted on the pre-reform sample produced a test statistic value of .7315 and a p-value of .0000. These values indicate a non-normal distribution for the pre-reform sample. The Shapiro-Wilk test conducted on the post-reform sample produced a test statistic value of .6685 and a p-value of less than .0001. These values indicate a non-normal distribution for the post-reform sample. At a significance level of .05, both results indicate both samples are non-normal, therefore more emphasis will be placed on the Mann-Whitney test results over the two-sample t-test.

The Levene test for equal variances produced a test statistic value of 1.6458 and a p-value of .2015. This result indicates that the population variances are equal at a significance level of .05. Therefore, the pooled t test results will be utilized in the analysis.

Hypothesis Test Results

The results of the hypothesis test are represented in Table 24. The test statistic values and associated p-values are consistent. At a significance level of .05, the results indicate that the null hypothesis is not rejected.

Table 24. Phase Three – Hypothesis Test #3 Results

Production Phase		
	Pre-Reform	Post-Reform
Mean FO%	8.9002	6.0459
Std Error	1.842	2.516
Test Results	**Mann-Whitney**	**Two-Sample t**
Test Statistic (Ws)	3619	-0.915
P-value	0.264	0.3615

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The Mann-Whitney results indicate that the two sample distributions do not differ in location and the two-sample t-test indicates the mean FO% for each sample is not significantly different. Both results suggest that the mean FO% of the pre-reform sample is equal to the mean FO% of the post-reform sample for production phase contracts.

Hypothesis Test #4 – Cost Plus Contracts

The fourth hypothesis tested to determine if the mean final cost overrun percentage (FO%) of cost-plus pre-reform contracts (1 Jan 91 – 31 Dec 94) is significantly different than the mean FO% of cost-plus post-reform contracts (1 Jan 95 – 31 Dec 98).

Normality and Equal Variance Test Results

The Shapiro-Wilk test conducted on the pre-reform sample produced a test statistic value of .7146 and a p-value of less than .0001. These values indicate a non-normal distribution for the pre-reform sample. The Shapiro-Wilk test conducted on the post-reform sample produced a test statistic value of .8537 and a p-value of less than .0001. These values indicate a non-normal distribution for the post-reform sample. At a significance level of .05, both results indicate both samples are non-normal, therefore more emphasis will be placed on the Mann-Whitney test results over the two-sample t-test.

The Levene test for equal variances produced a test statistic value of .1816 and a p-value of .6710. This result indicates that the population variances are equal at a significance level of .05. Therefore, the pooled t test results will be utilized in the analysis.

The results of the hypothesis test are represented in Table 25. The test statistic values and associated p-values are consistent. At a significance level of .05, the results indicate that the null hypothesis is not rejected.

Table 25. Phase Three – Hypothesis Test #4 Results

Cost Plus Contracts		
	Pre-Reform	Post-Reform
Mean FO%	8.4189	5.9602
Std Error	2.498	1.872
Test Results	**Mann-Whitney**	**Two-Sample t**
Test Statistic (Ws)	1536.5	-0.788
P-value	0.4118	0.4331

The Mann-Whitney results indicate that the two sample distributions do not differ in location and the two-sample t-test indicates the mean FO% for each sample is not significantly different. Both results suggest that the mean FO% of the pre-reform sample is equal to the mean FO% of the post-reform sample for cost plus contracts.

Hypothesis Test #5 – Fixed Price Contracts

The fifth hypothesis tested to determine if the mean final cost overrun percentage (FO%) of fixed price pre-reform contracts (1 Jan 91 – 31 Dec 94) is significantly different than the mean FO% of fixed price post-reform contracts (1 Jan 95 – 31 Dec 98).

Normality and Equal Variance Test Results

The Shapiro-Wilk test conducted on the pre-reform sample produced a test statistic value of .7591 and a p-value of .0000. These values indicate a non-normal distribution for the pre-reform sample. The Shapiro-Wilk test conducted on the post-reform sample produced a test statistic value of .8021 and a p-value of less than .0001.

These values indicate a non-normal distribution for the post-reform sample. At a significance level of .05, both results indicate both samples are non-normal, therefore more emphasis will be placed on the Mann-Whitney test results over the two-sample t-test.

The Levene test for equal variances produced a test statistic value of 1.9836 and a p-value of .1610. This result indicates that the population variances are equal at a significance level of .05. Therefore, the pooled t test results will be utilized in the analysis.

Hypothesis Test Results

The results of the hypothesis test are represented in Table 26. The test statistic values and associated p-values are consistent. At a significance level of .05, the results indicate that the null hypothesis is not rejected.

Table 26. Phase Three – Hypothesis Test #5 Results

Fixed Price Contracts		
	Pre-Reform	Post-Reform
Mean FO%	10.5542	6.9447
Std Error	1.638	2.579
Test Results	**Mann-Whitney**	**Two-Sample t**
Test Statistic (Ws)	3323	-1.181
P-value	0.1525	0.2392

The Mann-Whitney results indicate that the two sample distributions do not differ in location and the two-sample t-test indicates the mean FO% for each sample is not significantly different. Both results suggest that the mean FO% of the pre-reform sample is equal to the mean FO% of the post-reform sample for fixed price contracts.

Sensitivity Testing

As performed in Phase One, the same sensitivity testing for the effects of OTB and transitional contracts was conducted. Table 27 provides the new sample sizes for OTB contract removal in each respective category of hypothesis testing and Table 28 provides new sample sizes for the breakout of transitional from the post-reform samples in each respective category. The test results are contained in Appendix C. Like Phase One, the results were insensitive to any effects from OTB contracts, in that no significance differences were found. The results for testing for effects of transitional contracts by using the ANOVA and Kruskal-Wallis tests also indicated no significant differences in the three sample means at a .05 significance level.

Table 27. Phase Three Samples (OTB Removed)

Group	Pre-Reform	Post-Reform
	(1 Jan 91 - 31 Dec 94)	(1 Jan 95 - 31 Dec 98)
All DoD contracts	118 (38)	91 (25)
Program Phase		
Production	79 (18)	35 (17)
Development	27 (15)	36 (8)
Contract Type		
Cost Plus	23 (9)	50 (7)
Fixed Price	87 (27)	29 (17)

Table 28. Phase Three – Transitional Period Sensitivity Test Samples

Group	Pre-Reform	Transitional	Post-Reform
Contract Start	Prior to 31 Dec 1994	Prior to 31 Dec 1994	1 Jan 1995 or later
Contract Complete	Prior to 31 Dec 1994	1 Jan 1995 or later	1 Jan 1995 or later
All DoD contracts	156	106	10
Program Phase			
Production	97	47	5
Development	42	41	3
Contract Type			
Cost Plus	32	50	7
Fixed Price	114	42	2

Chapter Summary

Phase One tested to find if any differences between pre-reform and post-reform contract cost performance existed. With a reform treatment date of 31 December 1997, all five hypotheses test indicate that no difference exists. During the sensitivity testing for effects of over target baseline and transitional contracts, the results were consistent; no differences found. These results indicate no significant difference between pre-reform and post-reform contract cost performance with a treatment date of 31 December 1997.

Phase Two analysis provided a time series plot of contract cost performance over the span of the Defense Acquisition Executive Summary database timeframe. When plotted against major acquisition reform initiatives, contract cost performance appears to change at the time or immediately following each respective acquisition reform report or initiative. Applying some forecasting tools to describe and possibly model the change, the impact appears to be a decayed response, where the change in cost performance decays over time back to some steady state. This behavior is found to be common in both the development and production phases and for fixed price and cost plus contracts.

Phase Three tested the same hypotheses in Phase One, but with a new treatment date of 31 December 1994. The evidence of no difference noted in Phase One, some organizational changes within the DoD, and the cost performance behavior identified in Phase Two were the genesis for the new treatment date. The Phase Three results indicate no significant difference between pre-reform and post-reform contract cost performance. The results of sensitivity testing for effects of OTB and transitional contracts also indicated no significant differences between the sample means.

This concludes the results for both sets of hypothesis tests and the time series plot visual analysis. The statistical test results and p-values not shown in this chapter are in Appendix C and additional time series plots are available in Appendix D. Chapter 5 will draw conclusions on these results and discuss recommendations for future research and study.

V. Conclusion

Review of Research Objectives

This study started with two main objectives. First, to determine if a mapping existed between acquisition reform implementation and a change in contract cost performance. Second, if a mapping existed, to develop a rule of thumb to model this behavior. The use of hypothesis tests assessed any statistical indications of differences in final mean contract cost overrun percentages of pre-reform and post-reform contracts in the Phase One and Phase Three analyses. The hypotheses analyzed all Defense Department contracts and also analyzed breakouts of program phase and contract type to discern any differences. The Phase Two analysis involved plotting the contract cost variance data over time to see any trends or changes in relation to acquisition reform events. The results of all three phases meet the objectives stated above.

Discussion of Results

Phase One results indicated no statistically significant difference in the mean final cost overrun percentage of pre-reform contracts and post-reform contracts, utilizing 31 December 1997 as the treatment date. The results were consistent across the program phases and contract types.

Phase Two produced interesting results. In looking at the time plots of the contract cost variance percentages, there are noticeable performance changes. These changes in performance coincide with acquisition reform events. The consistency of these occurrences gives credence to the existence of a relationship between acquisition reform events and active contract cost performance. However, these changes are not

statistically quantified. The changes in cost variance percentage are based on a visual determination of the cost variance behavior in relationship to the acquisition reform timeline.

Phase Three was an attempt to reestablish a treatment date with information obtained from Phase Two as well as information of internal DoD activities toward acquisition reform implementation. Using a treatment date of 31 December 1994, the same hypotheses tested in Phase One were tested with new pre-reform and post-reform samples. The results indicated no statistically significant difference between pre-reform and post-reform contract cost performance. The results were consistent across program phases and contract types

Conclusions

The results of Phases One and Three indicate that acquisition reform events and initiatives have not significantly changed the final contract cost overrun percentage of completed contracts. While this is statistically true, this is not an indication that acquisition reform is not achieving intended goals. Any acquisition reform effects noted in initial program cost estimates and taken into account prior to initiating contracts would not be reflected in these results. The only acquisition reform impacts noted here would be impacts to the way contracts are controlled and managed to completion. The statistical tests indicate that cost performance, as reflected through earned value, is no different for post-reform contracts as compared to pre-reform contracts. These conclusions are also based on the selection of 31 December 1997 and 31 December 1994 as treatment dates for Phase One and Phase Three, respectively.

While the analysis of completed contracts indicates no change in performance, the Phase Two results tell a different story. Phase Two analyzed active contracts, regardless of percent complete. The plots indicate that active contract cost performance changes as a result of acquisition reform events. There appears to be a relationship between acquisition reform events and an immediate change in cost performance. However, without an in-depth analysis of each respective contract, this study cannot provide answers as to why such changes occurred and why they appear to be short-lived.

The results of this study are consistent with past empirical studies which analyzed contract cost performance following acquisition reform events. Christensen and Templin found that post A-12 contracts performed better than pre A-12 contracts. The difference in treatment dates and methodology employed account for the different results. Christensen and Templin utilized 31 December 1991 as the treatment date, while this study used dates 3 and 6 years later in this study. The results of this study indicate that post A-12 (31 December 1991), completed contract cost performance has not changed, for better or worse.

The results are also consistent with the Blueprint for Action report issued in February 2001. Any failure to succeed and meet the goals of acquisition reform is not from a lack of good ideas. For decades the same issues, problems and solutions have been exposed and offered by numerous commissions and panels (Druyun, 2001:41). The report points out that while "progress has been made on some fronts, a lack of top-level priority has limited the progress made to date" (Druyun, 2001:41). The push for transformation and the hard-hitting attitude of the Defense Department leadership is certainly encouraging and actions such as canceling the DoD 5000 series are indicative of

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its importance. However, unless this "change" movement is institutionalized by government acquisition and contractor personnel, history will repeat itself.

Recommendations for Future Research

There are three areas of future research that should be considered. First, the results of Phase Two should be explored in more detail. Study of a few contracts that experienced a change in contract cost performance during times of acquisition reform events may uncover what caused these changes. The question of "Are the changes from chance occurrences, or earned value and contract rebaselining activities, or by utilizing smart business practices and sound management?" needs to be answered. Lessons learned from this analysis could be very beneficial to the acquisition community for incorporation into other programs and contracts.

Pilot programs are often mentioned when discussing acquisition reform success stories. When analyzing the contracts in the DAES database associated with the acquisition pilot programs, the cost performance is favorable compared to the average. It may be worthwhile to study and find the underlying cause of these contracts' better than average cost performance to see if there are lessons learned to pass on to other programs as well. The results of this study could also provide the Department of Defense with further evidence that pilot programs are successful and should be expanded.

Finally, an analysis of program cost growth using Selected Acquisition Report (SAR) data should be conducted. This would provide a comparison to the conclusions of the Drezner, et al. study in 1993, to find if acquisition reform of the 1990's has truly affected the cost growth of DoD programs. The SAR analysis would uncover cost

growth or decline not reflected or evidenced in the DAES database, if it exists. This type

of analysis, coupled with this study, would provide a more complete answer to whether or

not acquisition reform activities in the 1990's has affected program cost growth.

Appendix A. DSMC Earned Value Management Gold Card

Defense Systems Management College
Earned Value Management Gold Card
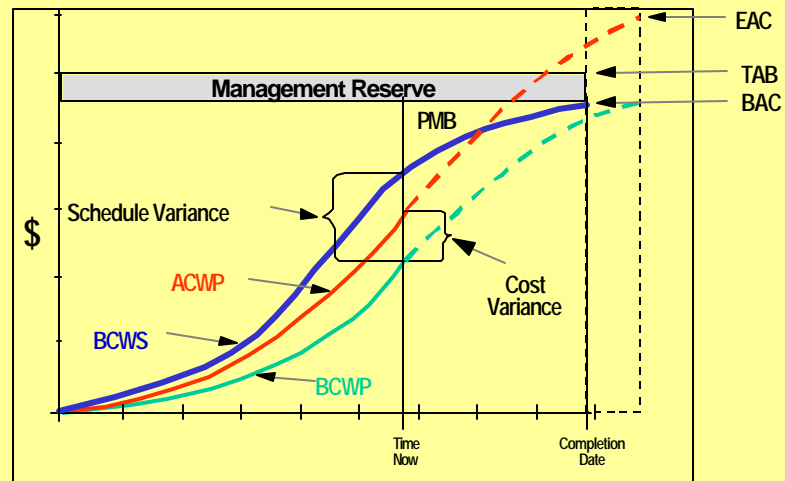
VARIANCES   *(Favorable is positive, Unfavorable is negative)*

- Cost Variance $CV = BCWP - ACWP$ $CV \% = CV / BCWP$
- Schedule Variance $SV = BCWP - BCWS$ $SV \% = SV / BCWS$
- Variance at Completion $VAC = BAC - EAC$

PERFORMANCE INDICES   *(Favorable is > 1.0, Unfavorable is < 1.0)*

- Cost Efficiency $CPI = BCWP / ACWP$

- Schedule Efficiency $SPI = BCWP / BCWS$

OVERALL STATUS

- Percent Complete $= \dfrac{BCWP\ CUM}{BAC}$

- Percent Spent $= \dfrac{ACWP\ CUM}{BAC}$

TO COMPLETE PERFORMANCE INDEX (TCPI)

$$TCPI_{(EAC)} = \frac{WORK\ REMAINING}{COST\ REMAINING} = \frac{BAC - BCWP\ CUM}{EAC - ACWP\ CUM}$$

ESTIMATE AT COMPLETION   (EAC = ACWP + Estimate for Remaining Work)

$$EAC_{CPI} = \frac{BAC}{CPI\ CUM} \qquad \cdot EAC_{Composite} = ACWP\ CUM + \frac{BAC - BCWP\ CUM}{(CPI\ CUM) \cdot (SPI\ CUM)}$$

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                          ┌──────────────────┐
                          │  Contract Price  │
                          └──────────────────┘
        ┌─────────────────────────────────────┐
        │  TAB                                 │   ┌──────────────┐
        │  ┌──────┐                            │   │ Profit / Fee │
        │  │ NCC  │──┐  ┌──────────┐           │   └──────────────┘
        │  ├──────┤  └─▶│  = CBB   │           │
        │  │+ AUW │     ├──────────┤  ┌────────┤
        │  └──────┘     │+ OVERRUN │─▶│ = OTB  │
        │               └──────────┘  └────────┘
        └─────────────────────────────────────┘
           ┌──────────────┐        ┌───────────────────────┐
           │     PMB      │        │  Management Reserve   │
           └──────────────┘        └───────────────────────┘
      ┌────────────────────┐      ┌────────────────────────┐
      │  Control Accounts  │      │  Undistributed Budget  │
      └────────────────────┘      └────────────────────────┘
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   └──────────────────┘   └────────────────────┘
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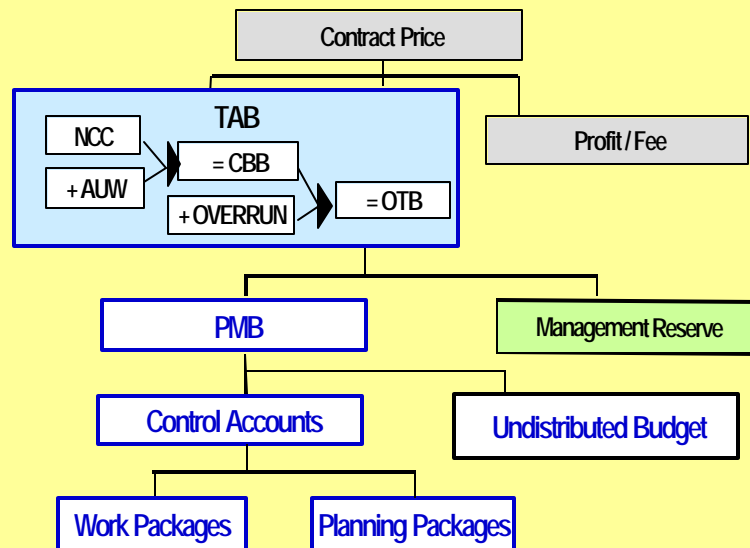
TERMINOLOGY

NCC	– Negotiated Contract Cost	Contract price less profit / fee
AUW	– Authorized Unpriced Work	Work authorized to start, not yet negotiated
CBB	– Contract Budget Base	Sum of NCC and AUW
OTB	– Over Target Baseline	Sum of CBB and recognized overrun
TAB	– Total Allocated Budget	Sum of all contract budgets - NCC, CBB or OTB (includes MR)
BAC	– Budget At Completion	Cumulative BCWS - total end point of PMB (excludes MR)
PMB	– Performance Measurement Baseline	Contract time-phased, budgeted work plan (excludes MR)
MR	– Management Reserve	Contractor PM's Contingency budget
UB	– Undistributed Budget	Broadly defined activities not yet distributed to CAs
CA	– Control Account	Contractor key management control point - CWBS element
WP	– Work Package	Near-term, detail-planned activities within a CA
PP	– Planning Package	Far-term CA activities not yet defined into detail Work Packages
BCWS	– Budgeted Cost for Work Scheduled	Value of work scheduled -- PLAN
BCWP	– Budgeted Cost for Work Performed	Value of work completed -- EARNED VALUE
ACWP	– Actual Cost of Work Performed	Cost of work completed – ACTUAL COSTS INCURRED
EAC	– Estimate At Completion	Estimate of total contract costs

EVM POLICY (DOD 5000.2-R)

ALTERNATIVE EV MANAGEMENT APPLICATIONS

LEVEL 1. EVMS Industry Standards Management Application

Contractor management system certified as meeting Industry Standards

- Required for non-FFP contract exceeding $73M RDT&E or $315M in procurement (CY00$).
- PM may apply to contracts below-threshold —consider benefits, risk and criticality.
- Contractor must establish, maintain, and use a system that meets the the 32 Industry Standards.
- Cost Performance Report (CPR) delivered as a CDRL item.
    - 5 Formats (WBS, Organization, Baseline, Staffing, and Explanations)

LEVEL 2. C/SSR Management Application

Contractor Management system not certified
- Required for non-FFP contract exceeding $6.3M (CY00$) and 12 months in length.
- 'Reasonably objective' EV methods acceptable, traceability at higher level (CA vs WP)
- The CPR or the Cost/Schedule Status Report (C/SSR) delivered as a CDRL item.

EVM Home Page — http://www.acq.osd.mil/pm/
DSMC EV E-Mail Address — EVM@DSMC.DSM.MIL
DSMC EV Phone No. — (703) 805-2848/2968 (DSN 655)

June 2000

Appendix B. Normal Probability Plots

Phase One – All DoD Contracts
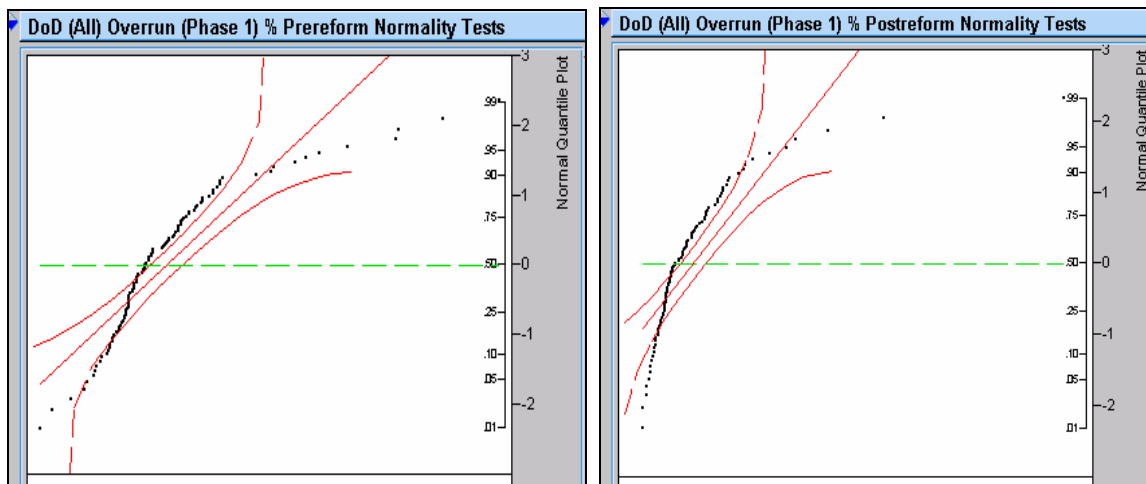
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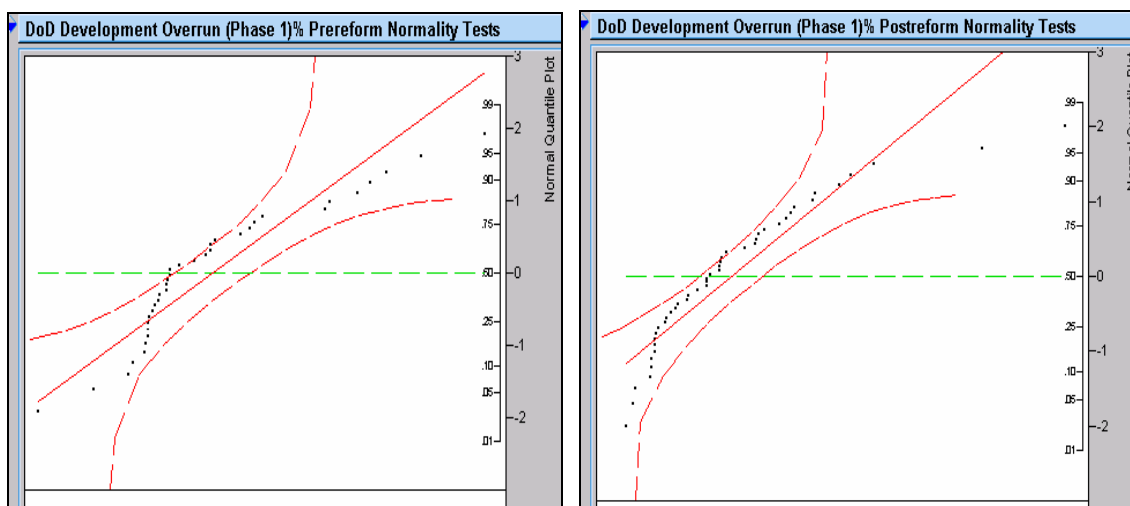
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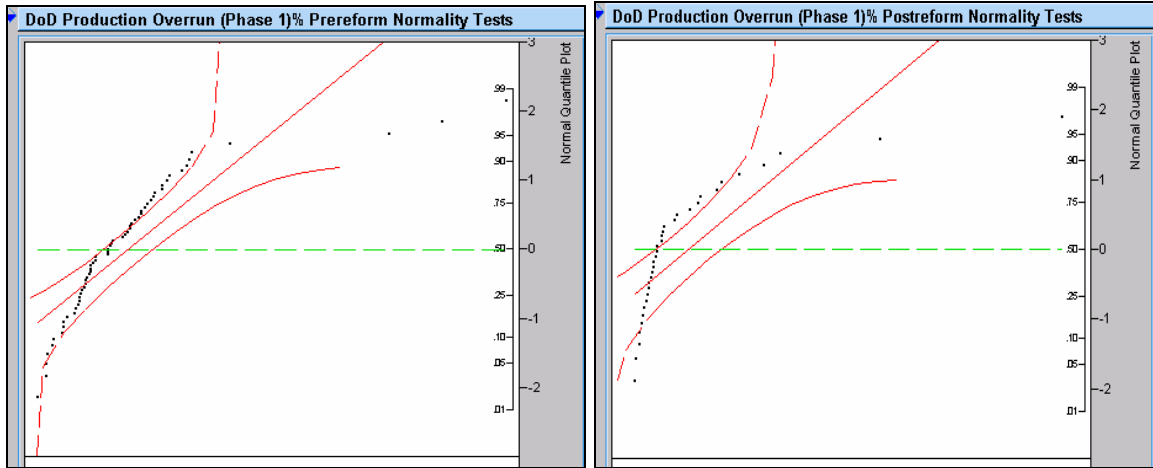
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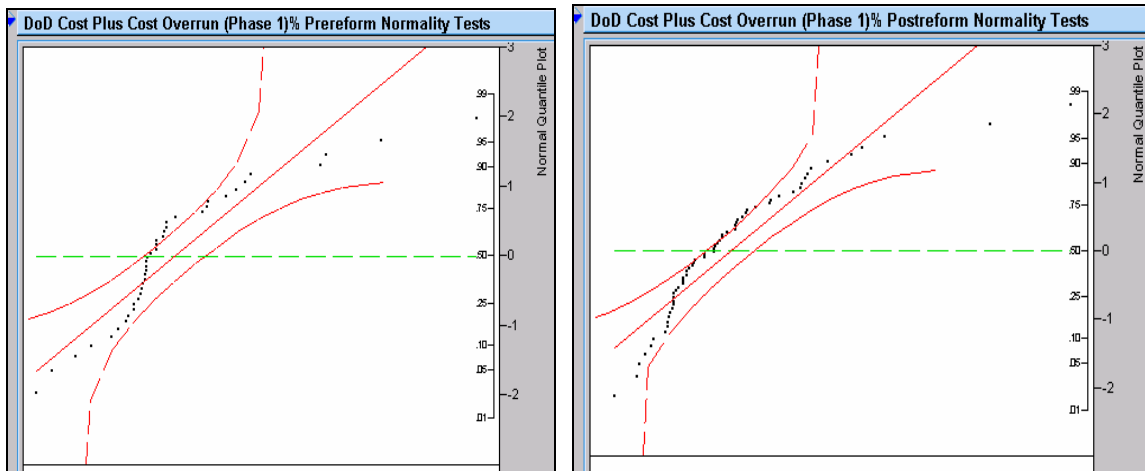
Phase One – Fixed Price Type Contracts
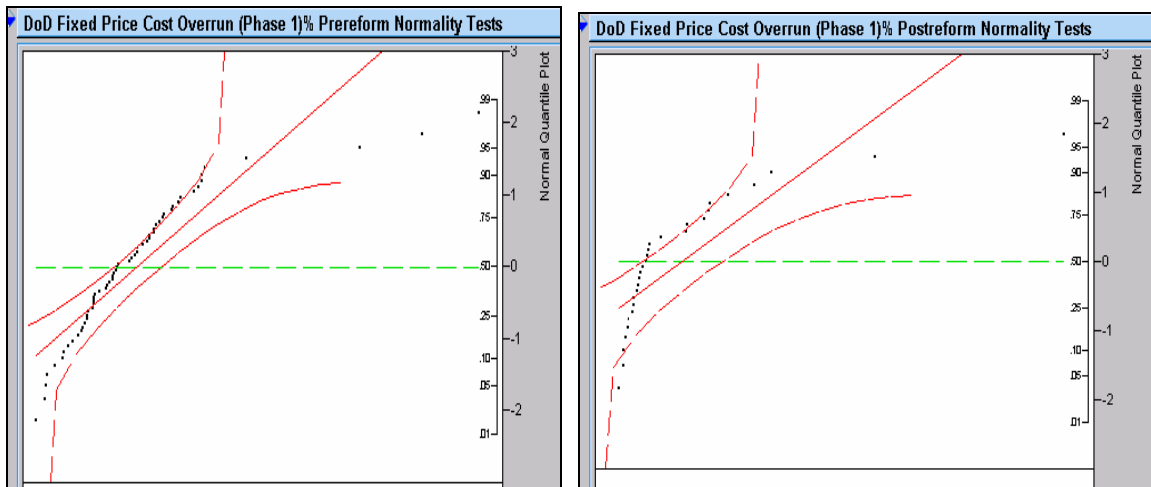
Phase Three –All DoD Contracts
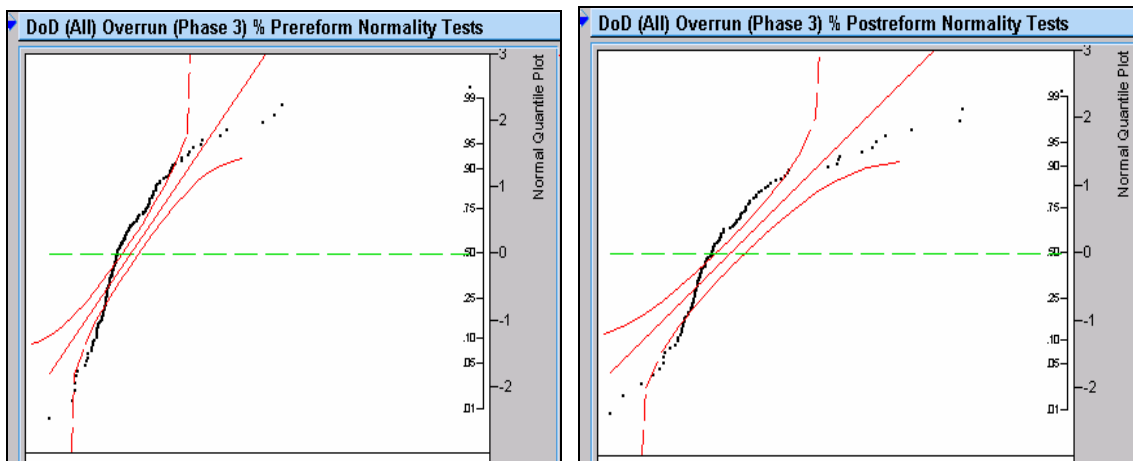
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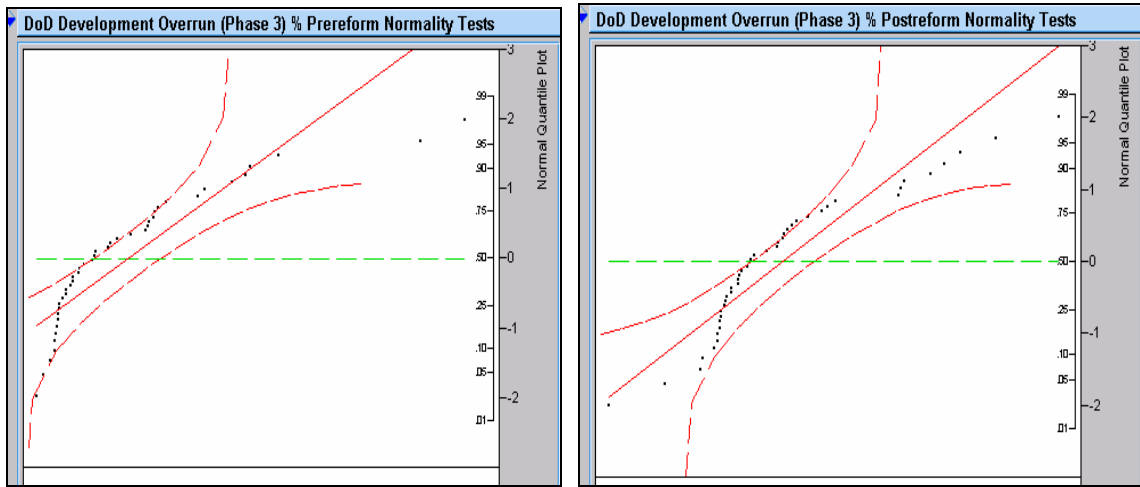
Phase Three – Production Phase Contracts
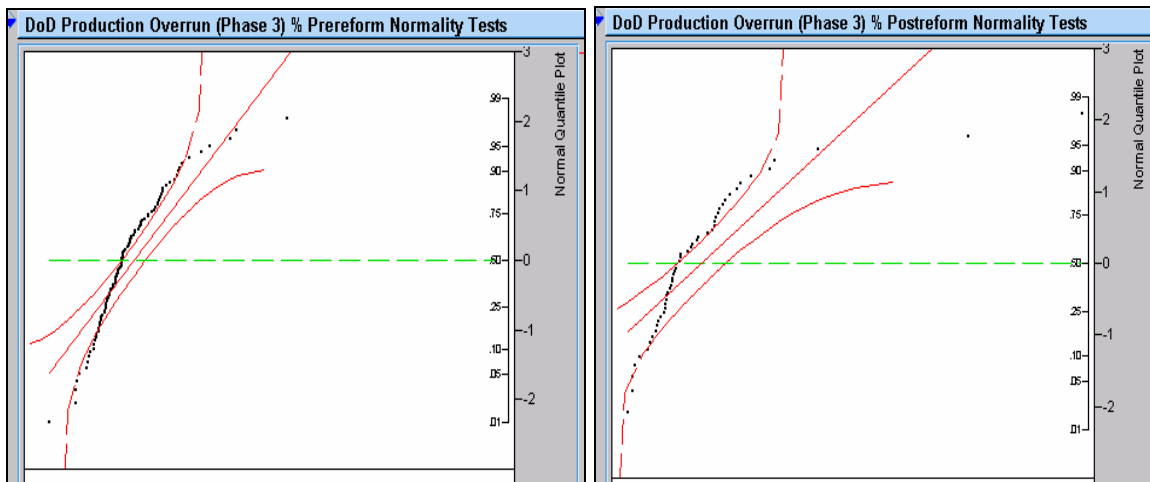
Phase Three – Cost Plus Type Contracts
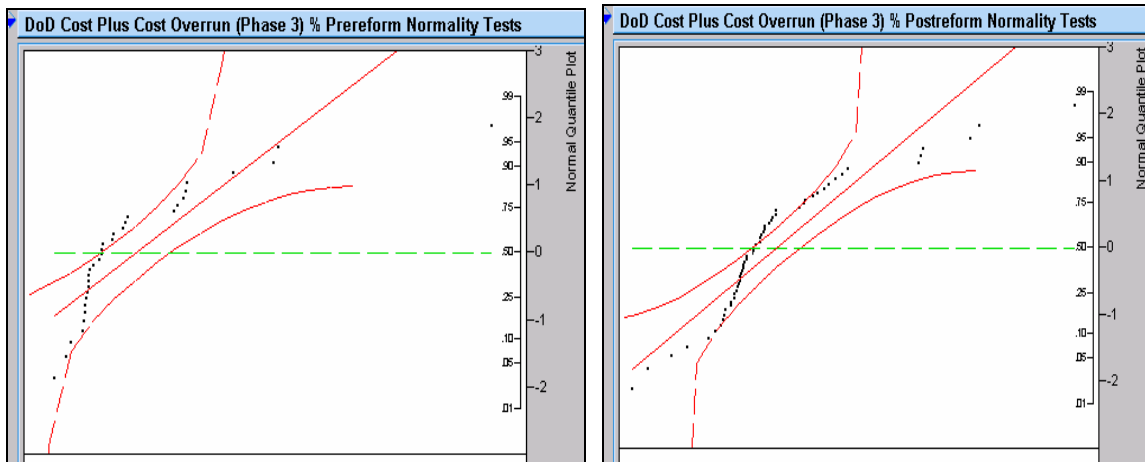
Phase Three – Fixed Price Type Contracts

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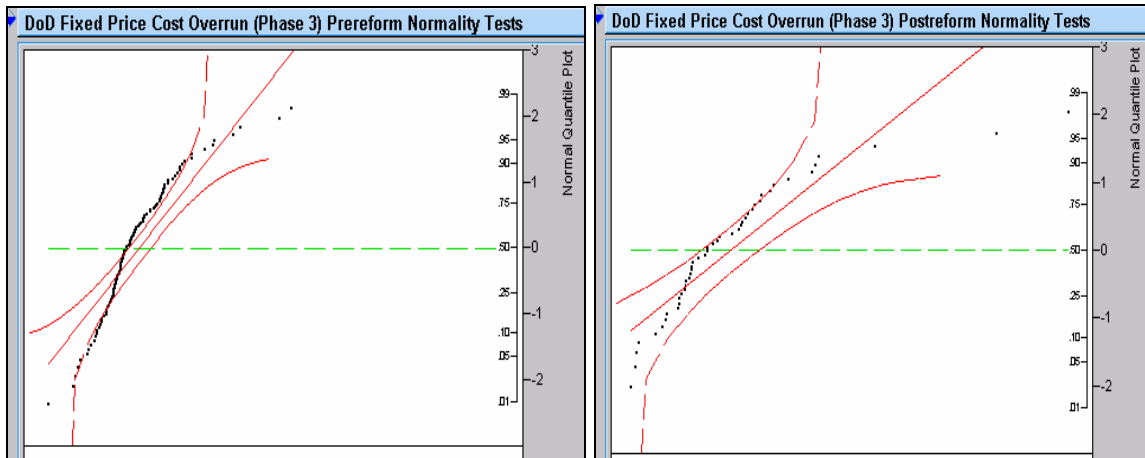
Appendix C. Hypothesis Sensitivity Results

Phase One Hypothesis Test Results (No OTB)

All DoD Contracts

	Pre-reform	Post-Reform	
Mean FO%	8.0033	6.1755	
Std Error	1.770	1.807	

Test Results	Mann-Whitney U	Two-Sample t	Levene
Test Statistic (Ws)	5159.5	-0.723	2.3354
P-value	0.5151	0.4711	0.1286

Development Contracts

	Pre-reform	Post-Reform	
Mean FO%	14.2662	6.7387	
Std Error	2.755	2.328	

Test Results	Mann-Whitney U	Two-Sample t	Levene
Test Statistic (Ws)	853	1.8639	18.3603
P-value	0.1772	0.0718	<.0001

Production Contracts

	Pre-reform	Post-Reform	
Mean FO%	6.3242	7.1845	
Std Error	2.929	3.541	

Test Results	Mann-Whitney U	Two-Sample t	Levene
Test Statistic (Ws)	767	0.187	1.3183
P-value	0.2894	0.8521	0.2553

Cost Plus Contracts

	Pre-reform	Post-Reform	
Mean FO%	5.2030	5.1440	
Std Error	2.102	1.734	

Test Results	Mann-Whitney U	Two-Sample t	Levene
Test Statistic (Ws)	1148	0.0193	8.2747
P-value	0.1891	0.9847	0.0042

Fixed Price Contracts

	Pre-reform	Post-Reform	
Mean FO%	9.6022	9.4828	
Std Error	3.360	4.177	

Test Results	Mann-Whitney U	Two-Sample t	Levene
Test Statistic (Ws)	560	-0.022	0.8982
P-value	0.2646	0.9823	0.3475

Phase One Hypothesis Test Results (Pre/Trans/Post)

All DoD Contracts

		Pre-Reform	Transitional	Post-Reform
Mean FO%		8.2522	6.2733	6.0043
Sample Size		109	86	9

Test Results		**Kruskal-Wallis**	**ANOVA**	**Levene**
	Test Statistic	1.2287	0.4771	1.4847
	P-value	0.541	0.6213	0.2291

Development Contracts

		Pre-Reform	Transitional	Post-Reform
Mean FO%		11.0208	7.0036	7.9658
Sample Size		36	40	4

Test Results		**Kruskal-Wallis**	**ANOVA**	**Levene**
	Test Statistic	0.6562	0.7901	6.3674
	P-value	0.7203	0.4792	0.0028

Production Contracts

		Pre-Reform	Transitional	Post-Reform
Mean FO%		8.1880	6.9401	5.4793
Sample Size		61	30	4

Test Results		**Kruskal-Wallis**	**ANOVA**	**Levene**
	Test Statistic	3.165	0.0851	0.3518
	P-value	0.2055	0.9184	0.7044

Cost Plus Contracts

		Pre-Reform	Transitional	Post-Reform
Mean FO%		5.1422	5.6923	3.9067
Sample Size		40	54	6

Test Results		**Kruskal-Wallis**	**ANOVA**	**Levene**
	Test Statistic	2.0025	0.481	4.3012
	P-value	0.3674	0.624	0.0162

Fixed Price Contracts

		Pre-Reform	Transitional	Post-Reform
Mean FO%		8.6052	8.6842	7.2758
Sample Size		59	24	5

Test Results		**Kruskal-Wallis**	**ANOVA**	**Levene**
	Test Statistic	2.6915	0.0157	1.3983
	P-value	0.2603	0.9844	0.2526

All DoD Contracts

	Pre-Reform	Transitional	Post-Reform
Mean FO%	8.0033	6.2000	6.0043
Sample Size	75	63	9

Test Results	**Kruskal-Wallis**	**ANOVA**	**Levene**
Test Statistic	0.7701	0.2599	1.2378
P-value	0.6804	0.7715	0.2931

Development Contracts

	Pre-Reform	Transitional	Post-Reform
Mean FO%	14.2662	6.5804	7.9658
Sample Size	25	31	4

Test Results	**Kruskal-Wallis**	**ANOVA**	**Levene**
Test Statistic	2.3459	1.6622	9.2635
P-value	0.3095	0.234	0.0003

Production Contracts

	Pre-Reform	Transitional	Post-Reform
Mean FO%	6.3242	7.4946	5.4793
Sample Size	38	22	4

Test Results	**Kruskal-Wallis**	**ANOVA**	**Levene**
Test Statistic	1.355	0.038	0.8105
P-value	0.5079	0.9627	0.4494

Cost Plus Contracts

	Pre-Reform	Transitional	Post-Reform
Mean FO%	5.2030	5.3250	3.9067
Sample Size	32	41	6

Test Results	**Kruskal-Wallis**	**ANOVA**	**Levene**
Test Statistic	1.9324	0.2798	5.0715
P-value	0.3805	0.7581	0.0086

Fixed Price Contracts

	Pre-Reform	Transitional	Post-Reform
Mean FO%	9.6022	10.1319	7.2758
Sample Size	34	17	5

Test Results	**Kruskal-Wallis**	**ANOVA**	**Levene**
Test Statistic	1.5357	0.0406	0.8603
P-value	0.464	0.9603	0.4288

Phase Three Hypothesis Test Results (No OTB)

All DoD Contracts

	Pre-reform	Post-Reform	
Mean FO%	9.2005	6.6208	
Std Error	1.606	1.828	

Test Results	Mann-Whitney U	Two-Sample t	Levene
Test Statistic (Ws)	9068.5	-1.06	1.5725
P-value	0.2622	0.2903	0.2113

Development Contracts

	Pre-reform	Post-Reform	
Mean FO%	12.8949	11.5267	
Std Error	3.293	2.852	

Test Results	Mann-Whitney U	Two-Sample t	Levene
Test Statistic (Ws)	886.5	-0.314	0.0049
P-value	0.7599	0.7545	0.9441

Production Contracts

	Pre-reform	Post-Reform	
Mean FO%	8.5848	3.3422	
Std Error	2.119	3.184	

Test Results	Mann-Whitney U	Two-Sample t	Levene
Test Statistic (Ws)	1770	-1.371	3.8944
P-value	0.1371	0.1731	0.0509

Cost Plus Contracts

	Pre-reform	Post-Reform	
Mean FO%	7.1253	5.6841	
Std Error	3.040	2.062	

Test Results	Mann-Whitney U	Two-Sample t	Levene
Test Statistic (Ws)	895.5	-0.392	0.0137
P-value	0.6013	0.696	0.9072

Fixed Price Contracts

	Pre-reform	Post-Reform	
Mean FO%	10.7687	6.8134	
Std Error	2.106	3.647	

Test Results	Mann-Whitney U	Two-Sample t	Levene
Test Statistic (Ws)	1471	-0.939	1.0090
P-value	0.1514	0.3496	0.3173

Phase Three Hypothesis Test Results (Pre/Trans/Post)

All DoD Contracts

	Pre-Reform	Transitional	Post-Reform
Mean FO%	9.3375	7.6530	4.7497
Sample Size	156	106	10

Test Results	**Kruskal-Wallis**	**ANOVA**	**Levene**
Test Statistic	5.3919	0.5866	0.6118
P-value	0.0675	0.5569	0.5431

Development Contracts

	Pre-Reform	Transitional	Post-Reform
Mean FO%	12.0260	11.5770	-0.2960
Sample Size	42	41	3

Test Results	**Kruskal-Wallis**	**ANOVA**	**Levene**
Test Statistic	4.4095	0.8477	1.7510
P-value	0.1103	0.4321	0.1800

Production Contracts

	Pre-Reform	Transitional	Post-Reform
Mean FO%	8.9002	5.5594	10.6196
Sample Size	97	47	5

Test Results	**Kruskal-Wallis**	**ANOVA**	**Levene**
Test Statistic	1.3977	0.5922	2.0189
P-value	0.4971	0.5544	0.1365

Cost Plus Contracts

	Pre-Reform	Transitional	Post-Reform
Mean FO%	8.4189	5.6881	7.9039
Sample Size	32	50	7

Test Results	**Kruskal-Wallis**	**ANOVA**	**Levene**
Test Statistic	1.593	0.3818	0.8778
P-value	0.4509	0.6838	0.4194

Fixed Price Contracts

	Pre-Reform	Transitional	Post-Reform
Mean FO%	10.5540	7.3429	-1.8150
Sample Size	114	44	2

Test Results	**Kruskal-Wallis**	**ANOVA**	**Levene**
Test Statistic	3.9158	0.9573	1.3362
P-value	0.1412	0.3862	0.2658

All DoD Contracts

	Pre-Reform	Transitional	Post-Reform
Mean FO%	9.2005	6.8518	4.7497
Sample Size	118	81	10

Test Results	**Kruskal-Wallis**	**ANOVA**	**Levene**
Test Statistic	4.4352	0.624	0.8724
P-value	0.1089	0.5368	0.4195

Development Contracts

	Pre-Reform	Transitional	Post-Reform
Mean FO%	12.8950	12.6015	-0.2960
Sample Size	27	33	3

Test Results	**Kruskal-Wallis**	**ANOVA**	**Levene**
Test Statistic	4.2747	0.8383	1.6368
P-value	0.118	0.4375	0.2032

Production Contracts

	Pre-Reform	Transitional	Post-Reform
Mean FO%	8.5848	2.1293	10.6196
Sample Size	79	30	5

Test Results	**Kruskal-Wallis**	**ANOVA**	**Levene**
Test Statistic	2.2196	2.9231	3.6008
P-value	0.3296	0.0982	0.0305

Cost Plus Contracts

	Pre-Reform	Transitional	Post-Reform
Mean FO%	7.1253	5.3227	7.9039
Sample Size	23	43	7

Test Results	**Kruskal-Wallis**	**ANOVA**	**Levene**
Test Statistic	0.8057	0.1694	0.6162
P-value	0.6684	0.8445	0.5429

Fixed Price Contracts

	Pre-Reform	Transitional	Post-Reform
Mean FO%	10.7690	7.4525	-1.8150
Sample Size	87	27	2

Test Results	**Kruskal-Wallis**	**ANOVA**	**Levene**
Test Statistic	3.5802	0.6449	0.8090
P-value	0.1669	0.5266	0.4478

Appendix D. Phase Two Time Series Plots

Development Phase Contracts

Production Phase Contracts

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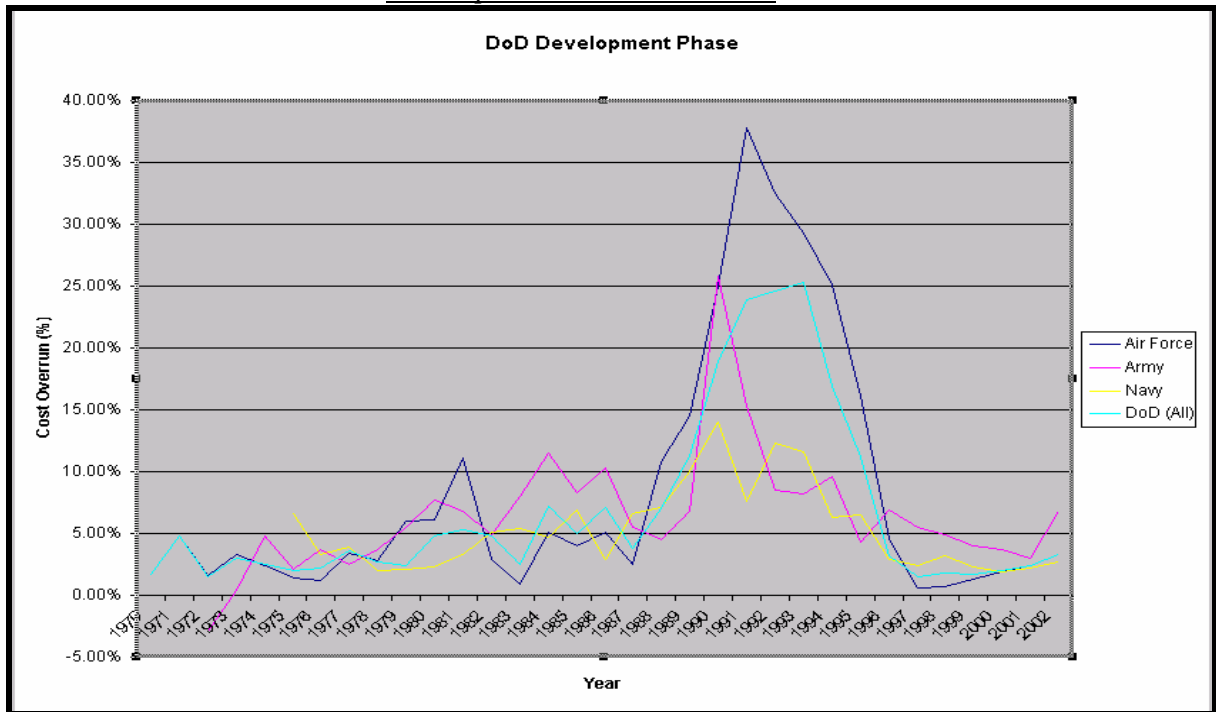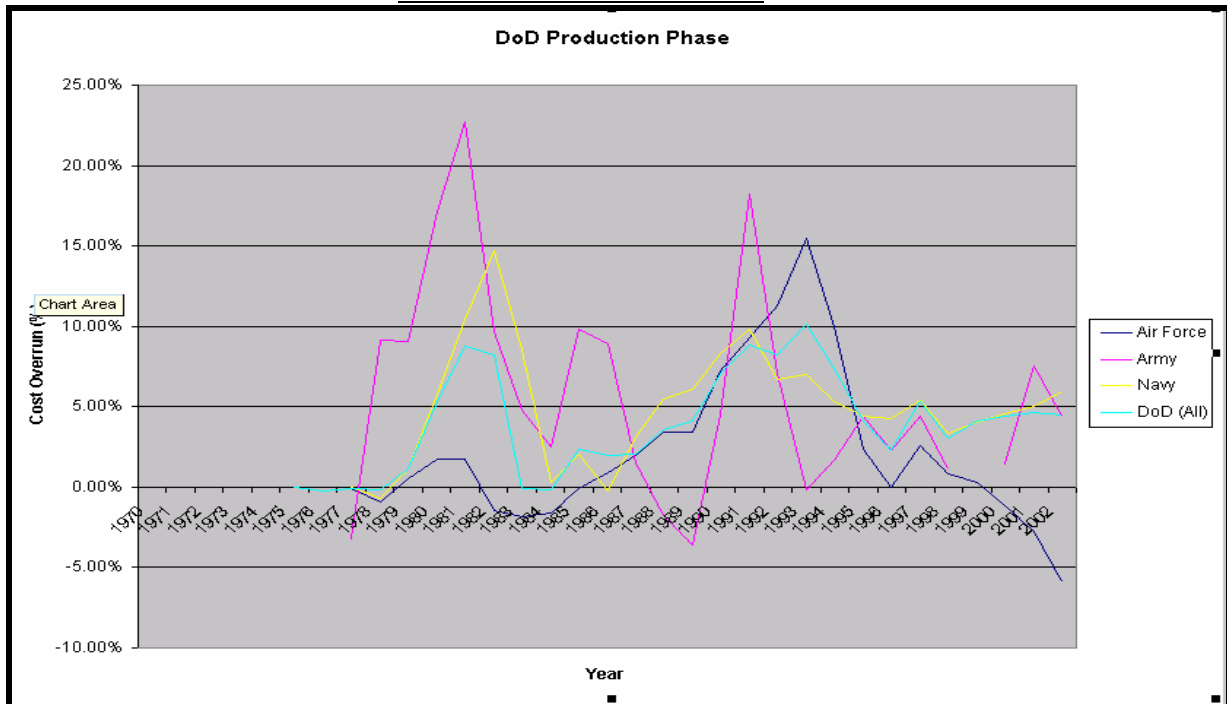
Cost Plus Type Contracts

Fixed Price Type Contracts

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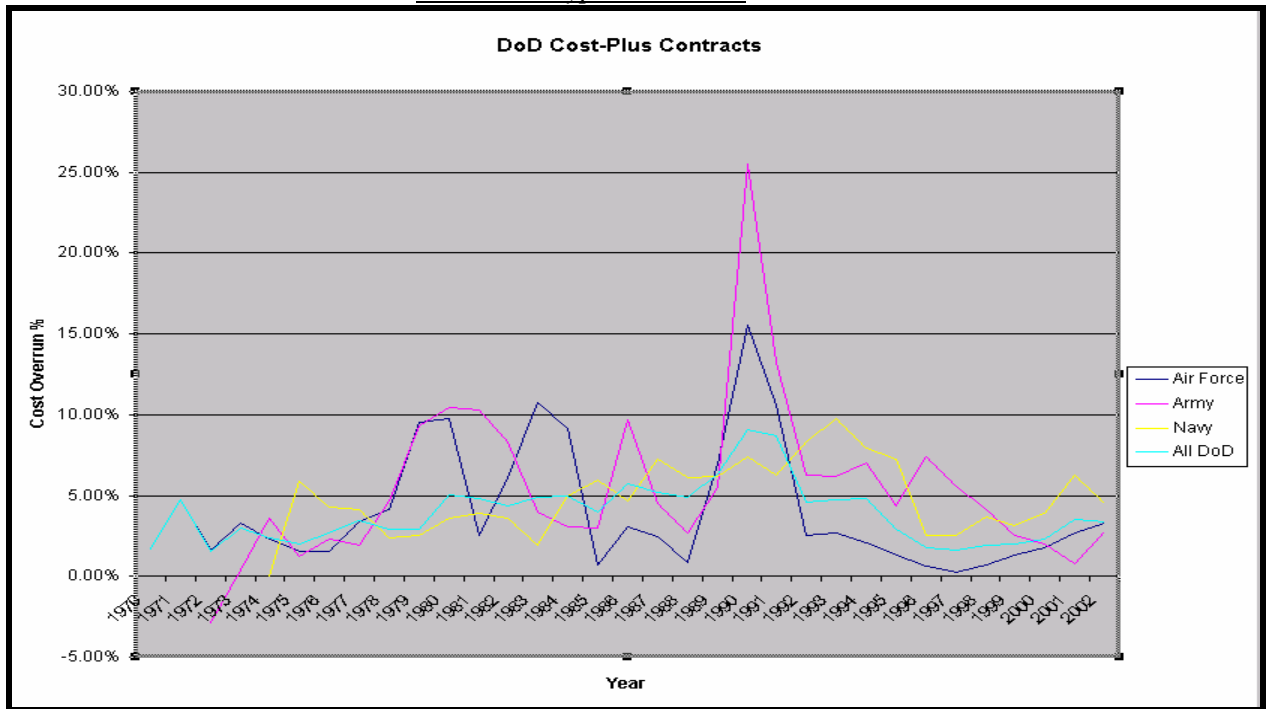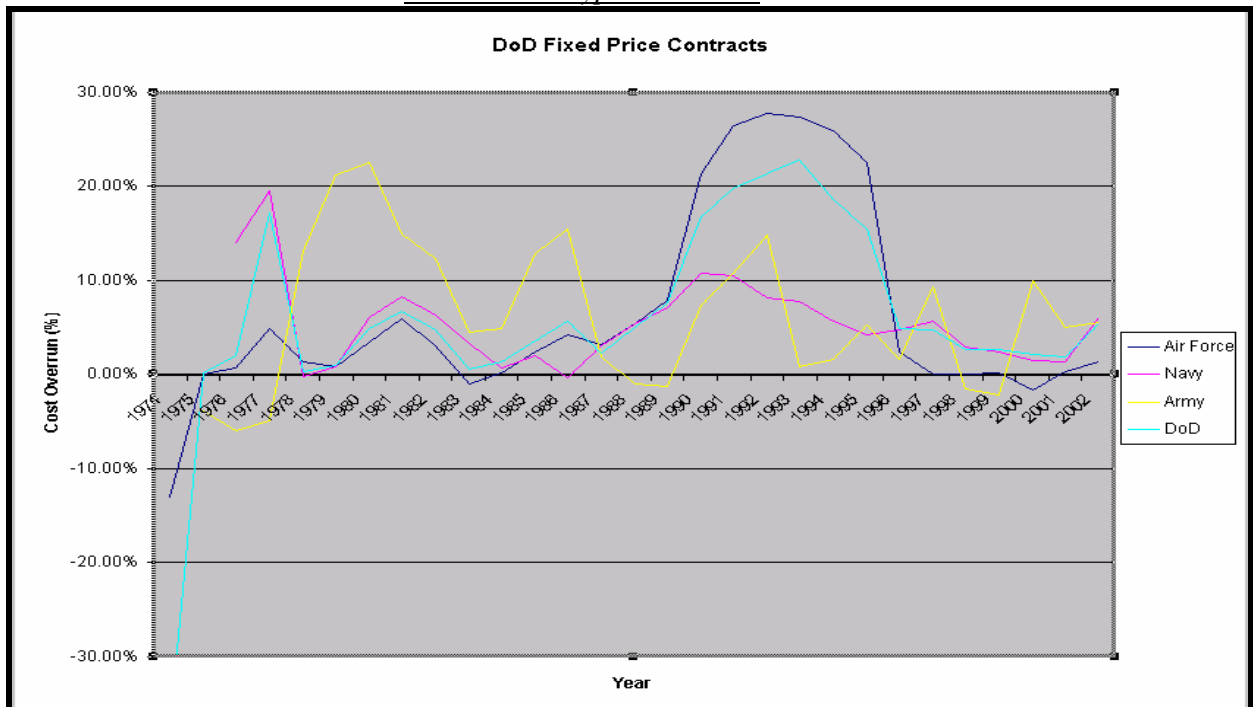
Appendix E. DAES Data

Phase One Data

Date	CV	CO%	ACWP	BCWP	BAC	Comp%	OTB	Trans.	Type	Phase
1/25/1994	-2.00	-2.46%	79.3	81.3	40.7	199.75%	Yes		FP	Dev
1/25/1994	1.40	1.30%	109.4	108	108.8	99.26%	Yes		FP	Prod
1/25/1994	6.70	3.86%	180.1	173.4	200.1	86.66%	No		FP	
3/25/1994	55.70	66.87%	139	83.3	83.8	99.40%	No		FP	Prod
4/25/1994	2.70	0.27%	1004	1001.3	1019.4	98.22%	No		CP	Prod
4/25/1994	64.90	14.59%	509.8	444.9	368.5	120.73%	Yes		FP	Prod
4/25/1994	4.60	4.53%	106.2	101.6	106.2	95.67%	No		FP	Prod
5/25/1994	16.70	3.78%	458.8	442.1	182.4	242.38%	Yes		CP	Dev
5/25/1994	2.90	15.76%	21.3	18.4	14.7	125.17%	Yes		CP	Dev
5/25/1994	0.90	0.08%	1088.5	1087.6	873.9	124.45%	Yes		FP	Dev
7/25/1994	12.50	17.34%	84.6	72.1	76.5	94.25%	No		CP	Dev
7/25/1994	309.20	27.33%	1440.6	1131.4	1158.4	97.67%	Yes		FP	Prod
7/25/1994	27.60	4.54%	635.1	607.5	787	77.19%	Yes		FP	Prod
7/25/1994	104.60	13.14%	900.9	796.3	998.8	79.73%	No		FP	Prod
8/25/1994	11.90	18.28%	77	65.1	49	132.86%	Yes		FP	Prod
8/25/1994	-11.70	-3.88%	289.9	301.6	309.3	97.51%	No		FP	Prod
8/25/1994	-13.40	-8.60%	142.4	155.8	163.8	95.12%	No		FP	Prod
8/25/1994	76.50	11.86%	721.6	645.1	551.3	117.01%	Yes		FP	Prod
9/25/1994	-7.00	-5.75%	114.8	121.8	134	90.90%	No		CP	Prod
9/25/1994	-1.70	-1.53%	109.6	111.3	114.8	96.95%	No		FP	Prod
10/25/1994	188.70	19.69%	1147	958.3	897.3	106.80%	Yes		FP	Prod
10/25/1994	85.50	9.51%	984.5	899	945.3	95.10%	No		FP	Prod
10/25/1994	36.50	12.47%	329.1	292.6	248.9	117.56%	Yes		FP	Prod
11/25/1994	-25.80	-5.52%	441.7	467.5	491	95.21%	Yes		FP	Prod
12/25/1994	36.50	5.02%	764	727.5	756.1	96.22%	No		FP	Prod
12/25/1994	16.00	10.70%	165.5	149.5	180.8	82.69%	No		FP	Prod
12/25/1994	127.60	14.73%	993.6	866	881	98.30%	No		FP	Prod
12/25/1994	88.10	16.01%	638.5	550.4	611.6	89.99%	No		FP	Prod
12/25/1994	106.40	7.75%	1478.5	1372.1	1447.7	94.78%	No		FP	Prod
12/25/1994	-1.00	-0.44%	224.4	225.4	215.1	104.79%	Yes		CP	Dev
1/25/1995	5.20	0.49%	1067.7	1062.5	1095.3	97.01%	No		CP	Prod
2/25/1995	-2.50	-3.20%	75.7	78.2	86.1	90.82%	No		CP	Dev
2/25/1995	41.70	5.39%	816	774.3	853.8	90.69%	No		FP	Prod
3/25/1995	1.70	3.46%	50.9	49.2	44.6	110.31%	Yes		CP	Dev
3/25/1995	51.50	11.47%	500.4	448.9	287.8	155.98%	Yes		FP	Prod
3/25/1995	1.20	1.31%	93.1	91.9	117.3	78.35%	No		FP	Prod
4/25/1995	-3.10	-15.90%	16.4	19.5	19.5	100.00%	No		CP	Mix
4/25/1995	5.70	3.53%	167.1	161.4	165.7	97.40%	No		FP	Mix
4/25/1995	22.30	8.23%	293.1	270.8	228	118.77%	Yes		FP	Prod
5/25/1995	2.70	0.96%	282.5	279.8	285.2	98.11%	No		CP	Dev
6/25/1995	27.20	37.94%	98.9	71.7	72.8	98.49%	No		Hybrid	Dev
6/25/1995	194.60	40.70%	672.7	478.1	485.5	98.48%	No		CP	Dev
7/25/1995	30.30	2.21%	1400.9	1370.6	1406.1	97.48%	No		FP	Prod
7/25/1995	0.30	0.29%	102.2	101.9	102.7	99.22%	No		FP	Prod

8/25/1995	11.80	10.63%	122.8	111	65.8	168.69%	Yes		FP	Prod
8/25/1995	11.40	19.16%	70.9	59.5	66.6	89.34%	No		FP	Prod
8/25/1995	17.70	10.66%	183.8	166.1	127.7	130.07%	Yes		CP	Dev
8/25/1995	1.90	2.07%	93.7	91.8	93.8	97.87%	No		CP	Dev
9/25/1995	-0.10	-0.35%	28.7	28.8	29	99.31%	No		CP	Dev
9/25/1995	1.80	3.74%	49.9	48.1	34.3	140.23%	Yes		CP	Dev
9/25/1995	2.70	1.09%	250.6	247.9	264.6	93.69%	No		FP	Prod
10/25/1995	114.10	30.28%	490.9	376.8	386.3	97.54%	No		CP	Dev
10/25/1995	29.10	10.28%	312.3	283.2	236.4	119.80%	Yes		FP	Prod
10/25/1995	0.70	3.18%	22.7	22	24.2	90.91%	No		CP	Dev
10/25/1995	-7.90	-9.23%	77.7	85.6	89.3	95.86%	No		CP	Dev
11/25/1995	-4.40	-3.83%	110.6	115	116.1	99.05%	No		Hybrid	Prod
11/25/1995	-36.00	-7.04%	475.2	511.2	526.8	97.04%	No		FP	Prod
11/25/1995	-2.60	-1.82%	140.3	142.9	155.9	91.66%	No		CP	
12/25/1995	72.60	46.60%	228.4	155.8	157.8	98.73%	No		FP	Dev
1/25/1996	2972.40	57.36%	8154.7	5182.3	5547.9	93.41%	No		FP	Dev
2/25/1996	26.10	31.11%	110	83.9	89	94.27%	No		CP	Dev
3/25/1996	7.50	12.93%	65.5	58	57.6	100.69%	Yes		FP	Prod
4/25/1996	12.10	10.82%	123.9	111.8	118.9	94.03%	No		CP	Dev
4/25/1996	-11.50	-1.80%	628.5	640	659.5	97.04%	No		CP	Prod
4/25/1996	52.10	8.86%	640.1	588	632	93.04%	No		Hybrid	Prod
4/25/1996	33.00	35.68%	125.5	92.5	95.8	96.56%	No		Hybrid	Dev
5/25/1996	0.70	0.17%	418.5	417.8	424.1	98.51%	No		CP	Dev
5/25/1996	-83.30	-7.10%	1089.4	1172.7	1099.8	106.63%	Yes		FP	Prod
5/25/1996	42.50	4.39%	1009.6	967.1	965.9	100.12%	Yes		FP	Prod
6/25/1996	35.50	3.28%	1118.6	1083.1	953	113.65%	Yes		FP	Dev
6/25/1996	-0.40	-0.70%	56.8	57.2	58.3	98.11%	No		CP	Prod
6/25/1996	-4.50	-0.84%	531.1	535.6	563	95.13%	No		FP	Prod
6/25/1996	-1.20	-2.88%	40.4	41.6	43.8	94.98%	No		CP	Training
7/25/1996	1.30	7.93%	17.7	16.4	17.1	95.91%	No		Hybrid	Dev
7/25/1996	-3.70	-0.27%	1382.7	1386.4	1421.2	97.55%	No		FP	Prod
7/25/1996	474.60	5.12%	9751.9	9277.3	10514.3	88.24%	No		FP	Mix
8/25/1996	13.90	1.96%	722.8	708.9	735.3	96.41%	Yes		CP	Dev
9/25/1996	0.00	0.00%	60.9	60.9	68.5	88.91%	No		CP	Dev
10/25/1996	5.00	5.39%	97.7	92.7	97.6	94.98%	No		CP	Dev
10/25/1996	0.20	0.26%	77.1	76.9	77.2	99.61%	No		CP	Dev
11/25/1996	10.50	11.39%	102.7	92.2	92	100.22%	No			Mix
11/25/1996	-63.50	-3.18%	1936.4	1999.9	1911	104.65%	Yes		FP	Prod
12/25/1996	3.40	14.05%	27.6	24.2	24.1	100.41%	No		CP	Mix
12/25/1996	56.00	0.28%	19765.1	19709.1	10014.8	196.80%	Yes		CP	Dev
12/25/1996	-67.00	-0.61%	10895.7	10962.7	11779.5	93.07%	Yes		FP	Prod
1/25/1997	11.90	9.88%	132.3	120.4	127.8	94.21%	No		CP	Dev
2/25/1997	8.10	7.26%	119.6	111.5	104.6	106.60%	Yes		FP	Prod
2/25/1997	26.60	18.22%	172.6	146	149.6	97.59%	No		CP	Dev
2/25/1997	69.60	78.82%	157.9	88.3	80.2	110.10%	Yes		Hybrid	Prod
4/25/1997	-5.60	-1.13%	488.9	494.5	520.6	94.99%	No		CP	Prod
5/25/1997	15.70	8.54%	199.6	183.9	189.3	97.15%	No		FP	Prod
5/25/1997	-31.90	-6.70%	444.4	476.3	512.7	92.90%	No		FP	Prod
5/25/1997	1.00	0.13%	767.8	766.8	706.2	108.58%	Yes		FP	Prod
6/25/1997	12.80	11.55%	123.6	110.8	122.5	90.45%	No		FP	Dev

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7/25/1997	87.60	15.61%	648.6	561	561	100.00%	No		FP	Prod
7/25/1997	26.10	8.67%	327.1	301	329.1	91.46%	No		FP	Prod
8/25/1997	0.80	2.05%	39.9	39.1	39.3	99.49%	No		OP	Mix
8/25/1997	-3.10	-4.47%	66.3	69.4	70	99.14%	No		OP	Mix
8/25/1997	-19.60	-18.63%	85.6	105.2	109.8	95.81%	No		OP	Dev
8/25/1997	-3.80	-4.09%	89.2	93	94.8	98.10%	No		FP	Prod
8/26/1997	9.90	5.26%	198.1	188.2	202	93.17%	No			Prod
9/25/1997	225.50	20.11%	1346.6	1121.1	1060.4	105.72%	Yes		FP	Prod
10/25/1997	3.90	2.20%	180.8	176.9	228.3	77.49%	No		Hybrid	Prod
10/25/1997	-57.40	-11.92%	424	481.4	500.6	96.16%	No		OP	Mix
11/25/1997	49.70	19.66%	302.5	252.8	255.6	98.90%	No		FP	Dev
11/25/1997	1.00	1.22%	83.1	82.1	85.9	95.58%	No		FP	Dev
11/25/1997	2.70	1.84%	149.7	147	157	93.63%	No		Hybrid	Prod
11/25/1997	13.00	57.02%	35.8	22.8	26.3	86.69%	No		OP	Prod
12/25/1997	9.60	1.24%	786.4	776.8	676.5	114.83%	Yes		FP	Prod
1/25/98	-0.1	-0.34%	29.4	29.5	29.6	99.66%	No	Yes	OP	Dev
1/25/98	181.3	28.47%	818.2	636.9	632.9	100.63%	Yes	Yes	FP	Prod
2/25/98	-0.9	-2.72%	32.2	33.1	41.7	79.38%	No	Yes	OP	Dev
3/25/98	18.3	30.65%	78	59.7	60.9	98.03%	Yes	Yes	OP	Dev
3/25/98	20.2	17.26%	137.2	117	120.2	97.34%	No	Yes	OP	Dev
4/25/98	6.9	4.04%	177.5	170.6	219.2	77.83%	No	Yes	OP	Prod
4/25/98	-19.6	-5.71%	323.5	343.1	382.2	89.77%	No	Yes	OP	Prod
5/25/98	2.4	5.17%	48.8	46.4	46.5	99.78%	No	Yes	OP	Dev
5/25/98	9.5	4.78%	208.2	198.7	233.9	84.95%	Yes	Yes	OP	Dev
5/25/98	6.8	3.91%	180.7	173.9	219.3	79.30%	No	Yes	OP	
7/25/98	7.4	13.03%	64.2	56.8	76.1	74.64%	No	Yes	OP	Dev
7/25/98	25.1	5.96%	446.5	421.4	442.8	95.17%	No	Yes	OP	Dev
7/25/98	8.2	14.94%	63.1	54.9	55.5	98.92%	No	Yes	OP	Dev
8/25/98	-0.2	-2.13%	9.2	9.4	10.9	86.24%	No	Yes	Mix	Prod
8/25/98	-3.3	-0.61%	534.9	538.2	552.4	97.43%	No	Yes	FP	Prod
9/25/98	6	9.71%	67.8	61.8	65.1	94.93%	No	Yes	Mix	Dev
9/25/98	0.9	0.92%	99.2	98.3	113.7	86.46%	No	Yes	OP	Dev
9/25/98	-7.3	-3.50%	201.5	208.8	223.8	93.30%	No	Yes	OP	Planning
9/25/98	109.3	13.50%	919	809.7	843.9	95.95%	Yes	Yes	FP	Prod
10/25/98	112	3.55%	3267.6	3155.6	3188.5	98.97%	No	Yes	FP	Prod
11/25/98	65.1	12.27%	595.7	530.6	534.5	99.27%	No	Yes	OP	Dev
11/25/98	4.1	0.83%	498.1	494	421.9	117.09%	Yes	Yes	FP	Prod
11/25/98	-5.7	-2.57%	215.8	221.5	243	91.15%	No	Yes	FP	Prod
11/25/98	0.6	0.46%	131.9	131.3	129.4	101.47%	No	Yes	FP	Prod
11/25/98	22.3	9.20%	264.8	242.5	246.8	98.26%	No	Yes	FP	Prod
11/25/98	11.9	9.57%	136.3	124.4	131.5	94.60%	No	Yes	FP	Prod
11/25/98	-6.3	-2.45%	250.5	256.8	283.7	90.52%	No	Yes	FP	Prod
2/25/99	31.9	8.40%	411.6	379.7	386.9	98.14%	No	Yes	OP	Dev
2/25/99	-11.4	-1.44%	781.9	793.3	683.1	116.13%	Yes	Yes	FP	Prod
4/25/99	7.7	4.56%	176.7	169	132.4	127.64%	Yes	Yes	OP	PDRR
4/25/99	22.9	7.08%	346.3	323.4	356.9	90.61%	No	Yes	OP	PDRR
4/25/99	4.6	1.29%	361.9	357.3	336.3	106.24%	Yes	Yes	OP	PDRR
4/25/99	0	0.00%	262.2	262.2	319.7	82.01%	No	Yes	OP	PDRR
4/25/99	74.8	13.35%	635.3	560.5	661.3	84.76%	No	Yes	OP	PDRR
5/25/99	19.7	6.23%	335.7	316	300.8	105.05%	Yes	Yes	OP	Dev

6/25/99	0	0.00%	276.3	276.3	249.5	110.74%	Yes	Yes	CP	Dev
7/25/99	5.7	1.49%	388.2	382.5	388.3	98.51%	No	Yes	CP	Dev
8/25/99	0.1	0.10%	102.7	102.6	106.7	96.16%	No	Yes	Mix	Dev
10/25/99	5.7	4.23%	140.6	134.9	149.4	90.29%	No	Yes	CP	PDRR
11/25/99	0.3	0.26%	114.3	114	118.4	96.28%	No	Yes	CP	Dev
11/25/99	-0.2	-0.50%	39.9	40.1	40.8	98.28%	No	Yes	CP	Dev
12/25/99	23.1	9.44%	267.7	244.6	244.7	99.96%	Yes	Yes	CP	Dev
2/25/00	-0.4	-0.36%	110.3	110.7	130.6	84.76%	No	Yes	CP	Dev
2/25/00	8.6	0.95%	913.2	904.6	907.9	99.64%	No	Yes	CP	PDRR
2/25/00	1.1	1.87%	59.9	58.8	58.7	100.17%	No	Yes	CP	
3/25/00	5.1	1.96%	265.8	260.7	289.9	89.93%	No	Yes	CP	Dev
3/25/00	0.1	0.26%	38.7	38.6	45.4	85.02%	No	NO	FP	Prod
4/25/00	-7.7	-3.71%	199.8	207.5	214.3	96.83%	No	Yes	FP	Prod
5/25/00	0.8	3.05%	27	26.2	26.7	98.13%	No	Yes	CP	Dev
5/25/00	67.8	18.28%	438.7	370.9	407.5	91.02%	No	Yes	CP	Dev
6/25/00	61.9	3.02%	2114	2052.1	1420	144.51%	Yes	Yes	CP	Dev
7/25/00	-1.9	-0.07%	2618.2	2620.1	3413.3	76.76%	Yes	Yes	CP	DEMVAL
7/25/00	28.2	38.37%	101.7	73.5	77.1	95.33%	No	Yes	CP	Dev
7/25/00	29.2	11.64%	280	250.8	254.5	98.55%	No	Yes	CP	Dev
8/25/00	6.2	6.70%	98.7	92.5	76.9	120.29%	Yes	Yes	CP	Dev
8/25/00	-21.8	-2.90%	730.9	752.7	668.9	112.53%	Yes	Yes	FP	Prod
8/25/00	-3.5	-4.87%	68.3	71.8	72.1	99.58%	No	Yes	FP	Prod
9/25/00	2.6	10.20%	28.1	25.5	25.8	98.84%	No	NO	CP	Dev
9/25/00	-38.1	-5.80%	618.8	656.9	689.5	95.27%	No	Yes	FP	Prod
9/25/00	0.7	1.26%	56.1	55.4	58.3	95.03%	No	Yes	CP	
9/25/00	4.5	7.89%	61.5	57	61.2	93.14%	No	Yes	CP	
11/25/00	0	0.00%	40.8	40.8	40.8	100.00%	No	Yes	CP	Dev
11/25/00	-11.6	-3.90%	285.9	297.5	314.6	94.56%	No	Yes	FP	Prod
11/25/00	161.4	18.81%	1019.4	858	879.5	97.56%	No	Yes	FP	Prod
1/25/01	34.6	1.02%	3441.1	3406.5	3420.8	99.58%	No	Yes	CP	Dev
1/25/01	62.8	9.30%	738.1	675.3	674.8	100.07%	Yes	Yes	CP	Dev
1/25/01	-8.2	-0.54%	1518.1	1526.3	1567.4	97.38%	No	Yes	CP	Prod
1/25/01	1.2	0.54%	223.3	222.1	225.3	98.58%	No	NO	CP	Prod
1/25/01	-63	-4.85%	1235.3	1298.3	1357	95.67%	No	Yes	FP	Prod
2/25/01	10.1	6.12%	175.2	165.1	168.4	98.04%	No	Yes	CP	Dev
2/25/01	-4.8	-0.97%	488.3	493.1	464.1	106.25%	Yes	Yes	FP	Prod
2/25/01	10	24.63%	50.6	40.6	44.7	90.83%	No	NO	FP	Prod
2/25/01	123.8	14.53%	975.9	852.1	924.1	92.21%	No	Yes	FP	Prod
4/25/01	14.2	7.14%	213	198.8	160.5	123.86%	Yes	Yes	CP	Prod
4/25/01	14.9	51.92%	43.6	28.7	30.8	93.18%	No	Yes	FP	Prod
4/25/01	16	94.67%	32.9	16.9	18.5	91.35%	No	Yes	FP	Prod
5/25/01	0	0.00%	71.2	71.2	85.3	83.47%	No	Yes	CP	Dev
5/25/01	6.2	3.94%	163.5	157.3	166.6	94.42%	No	Yes	CP	Dev
7/25/01	-3.5	-0.75%	462.3	465.8	507.5	91.78%	No	Yes	CP	Closure
7/25/01	6.1	1.03%	597.1	591	616.7	95.83%	No	NO	FP	Prod
7/25/01	-0.8	-1.31%	60.2	61	55.6	109.71%	Yes	Yes	FP	Prod
8/25/01	-2.7	-1.92%	137.8	140.5	155.7	90.24%	No	Yes	CP	Dev
8/25/01	10.6	14.74%	82.5	71.9	73.9	97.29%	No	NO	FP	Dev
9/25/01	-71.2	-2.12%	3287.4	3358.6	3524.2	95.30%	No	Yes	CP	Dev
9/25/01	39.9	12.36%	362.8	322.9	350.3	92.18%	No	Yes	CP	PDRR

9/25/01	-6.7	-3.27%	198.5	205.2	209.6	97.90%	No	Yes	OP	Phase II
10/25/01	-65.6	-4.29%	1465.1	1530.7	1602.6	95.51%	No	NO	FP	Prod
11/25/01	52.4	6.02%	922.9	870.5	672.8	129.38%	Yes	Yes	OP	Dev
11/25/01	15.1	12.73%	133.7	118.6	138.8	85.45%	No	Yes	OP	Dev
11/25/01	0.3	2.13%	14.4	14.1	16.1	87.58%	No	NO	OP	Dev
11/25/01	2.7	4.80%	59	56.3	66.2	85.05%	No	NO	OP	Dev
11/25/01	89.6	20.48%	527.2	437.6	514.3	85.09%	No	Yes	OP	Dev
11/25/01	-6.2	-3.03%	198.5	204.7	220.7	92.75%	No	Yes	Mix	Prod
12/25/01	-14.7	-1.68%	860.1	874.8	1161.7	75.30%	No	Yes	FP	Prod
12/25/01	3.9	4.87%	84	80.1	82.7	96.86%	No	Yes	Mix	Dev

Phase Three Data

Date	CV	CO %	ACWP	BCWP	BAC	Comp %	OTB	Trans.	Type	Phase
1/17/91	4.1	2.69%	156.5	152.4	144.5	105.47%	No		CP	DEV
1/25/91	3.1	3.52%	91.1	88	28.2	312.06%	Yes		FP	DEV
2/25/91	16.8	10.20%	181.5	164.7	165.2	99.70%	No		FP	DEV
2/25/91	41.5	6.27%	703.1	661.6	666.1	99.32%	No		CP	DEV
2/25/91	1.3	1.51%	87.6	86.3	87.6	98.52%	No		FP	DEV
3/25/91	28.5	18.45%	183	154.5	156.4	98.79%	No		FP	Prod
3/25/91	-16.5	-3.82%	415.3	431.8	469.3	92.01%	No		Mix	Prod
3/25/91	7.2	4.45%	169.1	161.9	168.7	95.97%	No		CP	Prod
3/25/91	-1.3	-1.61%	79.4	80.7	88.2	91.50%	No		FP	Prod
4/25/91	3.2	3.81%	87.1	83.9	89.1	94.16%	No		FP	DEV/PROD
4/25/91	0	0.00%	85.5	85.5	94.6	90.38%	No		CP	DEV
4/25/91	94.5	25.27%	468.5	374	382.9	97.68%	No		CP	DEV
4/25/91	6.1	17.09%	41.8	35.7	37.5	95.20%	No		FP	Prod
5/25/91	-56.1	-13.66%	354.7	410.8	470	87.40%	No		FP	
5/25/91	55.7	7.21%	828.7	773	670.8	115.24%	Yes		FP	
6/25/91	3.2	3.70%	89.7	86.5	88.8	97.41%	No		FP	DEV
6/25/91	2.5	0.89%	282.4	279.9	290.2	96.45%	No		FP	DEV
6/25/91	-0.6	-1.31%	45.1	45.7	47.9	95.41%	Yes		FP	DEV
6/25/91	6.5	4.59%	148.1	141.6	148.1	95.61%	No		FP	Prod
6/25/91	-10.4	-12.67%	71.7	82.1	99.5	82.51%	No		Mix	Prod
7/10/91	0	0.00%	27668	27668	10299	268.65%	Yes			
7/25/91	1.8	1.74%	105.5	103.7	104.4	99.33%	No		FP	Devel/Prod
7/25/91	44.8	15.07%	342.1	297.3	303.8	97.86%	No		CP	DEV
7/25/91	32.2	34.70%	125	92.8	99.4	93.36%	No		FP	Prod
7/25/91	50.5	18.94%	317.1	266.6	283.5	94.04%	No		FP	Prod
7/25/91	14.7	2.08%	721.4	706.7	730.4	96.76%	No		FP	Prod
7/25/91	13.5	7.40%	195.9	182.4	194	94.02%	No		FP	Prod
8/25/91	14	24.65%	70.8	56.8	49.2	115.45%	Yes		FP	Prod
8/25/91	8.2	9.11%	98.2	90	90	100.00%	No		FP	DEV
9/25/91	7.9	2.55%	317.4	309.5	344.2	89.92%	Yes		CP	DEV
9/25/91	38.1	16.49%	269.1	231	306.2	75.44%	No		FP	DEV
9/25/91	23.1	5.88%	416.1	393	246.7	159.30%	Yes		FP	DEV
9/25/91	-3.8	-3.97%	91.8	95.6	95.5	100.10%	No		FP	Prod
10/25/91	-15.8	-2.88%	532.3	548.1	559.9	97.89%	No		CP	Prod
10/25/91	2.5	6.91%	38.7	36.2	41.8	86.60%	No		FP	Prod
10/25/91	32.1	4.01%	832	799.9	828.1	96.59%	No		FP	Prod
11/25/91	13.6	9.41%	158.2	144.6	151.6	95.38%	No		FP	Prod
11/25/91	2.7	2.60%	106.4	103.7	108.8	95.31%	No		FP	Prod
12/25/91	5.9	1.46%	410.5	404.6	409	98.92%	No		FP	DEV
12/25/91	0.4	0.24%	169.3	168.9	171.8	98.31%	No		FP	DEV
12/25/91	71.6	37.82%	260.9	189.3	190.8	99.21%	No		FP	Prod
12/25/91	35.2	21.18%	201.4	166.2	175.1	94.92%	No		FP	Prod
1/25/92	11.9	18.62%	75.8	63.9	66.1	96.67%	No		FP	DEV
1/25/92	9.5	15.63%	70.3	60.8	65.9	92.26%	No		Mix	DEV
1/25/92	-5.7	-7.30%	72.4	78.1	79.2	98.61%	No		FP	Prod
1/25/92	52.9	9.13%	632.4	579.5	589.3	98.34%	No		FP	Prod
1/25/92	7.3	1.80%	412.8	405.5	445.8	90.96%	No		FP	QT

1/25/92	-5.1	-3.66%	134.3	139.4	140.3	99.36%	No	CP	DEV
2/25/92	176.5	38.09%	639.9	463.4	424.1	109.27%	Yes	FP	DEV
2/25/92	28.4	25.75%	138.7	110.3	114.5	96.33%	No	FP	Prod
2/25/92	2.4	1.10%	219.6	217.2	159.3	136.35%	Yes	FP	
2/25/92	97.3	19.48%	596.7	499.4	384.8	129.78%	Yes	FP	
3/25/92	13.2	12.54%	118.5	105.3	127.9	82.33%	No	FP	DEV
3/25/92	-3.1	-0.35%	872.4	875.5	917.8	95.39%	No	CP	DEV
3/25/92	72.2	29.77%	314.7	242.5	247.6	97.94%	No	FP	Prod
3/25/92	14.9	5.89%	268	253.1	264.5	95.69%	No	FP	Prod
3/25/92	5.2	8.39%	67.2	62	62.1	99.84%	No	FP	Prod
4/15/92	54	45.26%	173.3	119.3	126.8	94.09%	No	FP	Prod
4/25/92	311.6	26.56%	1484.8	1173.2	1182.2	99.24%	No	FP	Prod
4/25/92	75.2	32.33%	307.8	232.6	175.6	132.46%	Yes	CP	DEV
5/25/92	1.4	1.15%	123.6	122.2	118.5	103.12%	Yes	CP	DEM/VAL
5/25/92	18.5	17.18%	126.2	107.7	124.7	86.37%	No	CP	DEM/VAL
5/25/92	25.1	16.98%	172.9	147.8	149.5	98.86%	No	FP	Prod
5/25/92	-1.4	-0.40%	348.4	349.8	376.1	93.01%	No	FP	Prod
5/25/92	23	11.84%	217.2	194.2	201.5	96.38%	No	FP	Prod
5/25/92	-31.6	-5.23%	572.9	604.5	620.1	97.48%	No	FP	Prod
5/25/92	15.2	6.98%	233.1	217.9	261.7	83.26%	No	CP	SDS
5/25/92	57.7	12.09%	535.1	477.4	508.5	93.88%	No	FP	
6/6/92	-0.6	-0.49%	122.4	123	143.5	85.71%	No	CP	
6/25/92	28.1	7.40%	408	379.9	385.7	98.50%	No	FP	Prod
6/25/92	0.5	0.25%	204.4	203.9	224.8	90.70%	No	CP	DEV
7/25/92	4.1	0.50%	822.9	818.8	837.6	97.76%	No	CP	Prod
7/25/92	-40.2	-3.20%	1216.2	1256.4	1194.5	105.18%	Yes	FP	Prod
8/25/92	-12	-12.26%	85.9	97.9	126.8	77.21%	No	FP	Prod
9/25/92	40.1	47.74%	124.1	84	85.8	97.90%	No	FP	Prod
9/25/92	-2	-1.69%	116.1	118.1	137.7	85.77%	No	Mix	Prod
10/25/92	1	0.86%	117.9	116.9	126.4	92.48%	No	FP	Mix
10/25/92	24.3	62.47%	63.2	38.9	41.3	94.19%	No	FP	DEV
10/25/92	155.5	8.73%	1936.1	1780.6	1529.7	116.40%	Yes	FP	DEV
10/25/92	1.4	1.22%	116.4	115	119.1	96.56%	No	FP	Prod
11/1/92	-9.3	-7.53%	114.2	123.5	130.5	94.64%	No	Mix	Prod
11/25/92	14.7	7.77%	203.8	189.1	232.8	81.23%	No	FP	Prod
11/25/92	4.4	2.31%	194.6	190.2	194.9	97.59%	No	FP	Prod
11/25/92	18.8	30.08%	81.3	62.5	66.3	94.27%	No	FP	DEV
12/25/92	2.9	2.20%	135	132.1	142.9	92.44%	No	FP	Prod
12/25/92	-0.1	-0.56%	17.6	17.7	18.5	95.68%	No	FP	DEV
1/22/93	20.2	33.06%	81.3	61.1	67.7	90.25%	Yes	CP	DEV
1/25/93	0.3	0.18%	165	164.7	171.4	96.09%	No	CP	Prod
1/25/93	-2.9	-1.19%	240.8	243.7	280.7	86.82%	No	Mix	Prod
1/25/93	-0.1	-0.04%	222.6	222.7	236.3	94.24%	No	Mix	Prod
1/25/93	-12.2	-3.77%	311.5	323.7	349.2	92.70%	No	Mix	Prod
1/25/93	-13.3	-8.12%	150.5	163.8	171.5	95.51%	No	FP	Prod
1/25/93	5.7	4.32%	137.7	132	137	96.35%	No	FP	Prod
1/25/93	19.7	16.69%	137.7	118	90.3	130.68%	Yes	CP	DEV
2/25/93	22.2	24.05%	114.5	92.3	93	99.25%	No	FP	DEV
2/25/93	3.6	3.85%	97.2	93.6	98.9	94.64%	No	FP	Prod
2/25/93	3.5	3.38%	106.9	103.4	108.3	95.48%	No	FP	Prod

2/25/93	5.8	3.68%	163.5	157.7	167.9	93.92%	No	FP	
3/25/93	1.2	2.20%	55.8	54.6	57.6	94.79%	No	CP	DEV
3/25/93	23.3	25.55%	114.5	91.2	95	96.00%	No	FP	Prod
3/25/93	44.2	19.91%	266.2	222	232.4	95.52%	Yes	FP	Prod
3/25/93	42.5	8.13%	565.5	523	296	176.69%	Yes	FP	Prod
3/25/93	-5.8	-5.05%	109	114.8	120.8	95.03%	No	FP	Prod
3/25/93	-4.4	-12.83%	29.9	34.3	34.3	100.00%	No	FP	Prod
4/25/93	4.6	6.63%	74	69.4	72.3	95.99%	No	CP	DEV
4/25/93	12.5	3.10%	416	403.5	442.7	91.15%	No	FP	Prod
5/25/93	26.9	70.05%	65.3	38.4	38.4	100.00%	No	CP	DEV
5/25/93	117.8	145.07%	199	81.2	84	96.67%	No	FP	Prod
5/25/93	21.9	11.26%	216.4	194.5	199.8	97.35%	No	FP	Prod
5/25/93	-7.8	-5.83%	126.1	133.9	141.6	94.56%	No	FP	Prod
6/25/93	10.7	18.23%	69.4	58.7	61.6	95.29%	No	FP	Prod
6/25/93	144.1	20.03%	863.6	719.5	722.8	99.54%	No	FP	Prod
6/25/93	-2.4	-3.15%	73.8	76.2	81.3	93.73%	No	FP	Prod
6/25/93	-7.3	-22.96%	24.5	31.8	32.8	96.95%	No	FP	Prod
7/25/93	19.3	2.45%	808.2	788.9	796.7	99.02%	No	CP	Prod
8/25/93	50.6	22.84%	272.1	221.5	194.1	114.12%	Yes	FP	Prod
8/25/93	32.5	5.19%	658.5	626	731	85.64%	No	FP	Prod
8/25/93	-58.1	-11.33%	454.7	512.8	540	94.96%	No	FP	Prod
9/17/93	46.6	21.45%	263.9	217.3	271	80.18%	No	FP	
9/25/93	-1.3	-0.74%	173.2	174.5	219.1	79.64%	No	CP	Prod
10/25/93	-2	-0.85%	234.2	236.2	208.6	113.23%	Yes	Mix	Prod
10/25/93	75	5.36%	1475.2	1400.2	1061.3	131.93%	Yes	FP	Prod
10/25/93	-8.9	-1.44%	609.9	618.8	610.7	101.33%	Yes	FP	Prod
11/25/93	-0.1	-0.06%	168.9	169	119.3	141.66%	Yes	CP	DEV
12/25/93	23.8	5.19%	482.2	458.4	290.3	157.91%	Yes	FP	Prod
1/25/94	-2	-2.46%	79.3	81.3	40.7	199.75%	Yes	FP	DEV
1/25/94	1.4	1.30%	109.4	108	108.8	99.26%	Yes	FP	Prod
1/25/94	6.7	3.86%	180.1	173.4	200.1	86.66%	No	FP	
3/25/94	55.7	66.87%	139	83.3	83.8	99.40%	No	FP	Prod
4/25/94	2.7	0.27%	1004	1001.3	1019.4	98.22%	No	CP	Prod
4/25/94	64.9	14.59%	509.8	444.9	368.5	120.73%	Yes	FP	Prod
4/25/94	4.6	4.53%	106.2	101.6	106.2	95.67%	No	FP	Prod
5/25/94	2.9	15.76%	21.3	18.4	14.7	125.17%	Yes	CP	DEV
5/25/94	0.9	0.08%	1088.5	1087.6	873.9	124.45%	Yes	FP	DEV
7/25/94	12.5	17.34%	84.6	72.1	76.5	94.25%	No	CP	DEV
7/25/94	309.2	27.33%	1440.6	1131.4	1158.4	97.67%	Yes	FP	Prod
7/25/94	104.6	13.14%	900.9	796.3	998.8	79.73%	No	FP	Prod
7/25/94	27.6	4.54%	635.1	607.5	787	77.19%	Yes	FP	Prod
8/25/94	11.9	18.28%	77	65.1	49	132.86%	Yes	FP	Prod
8/25/94	-11.7	-3.88%	289.9	301.6	309.3	97.51%	No	FP	Prod
8/25/94	-13.4	-8.60%	142.4	155.8	163.8	95.12%	No	FP	Prod
8/25/94	76.5	11.86%	721.6	645.1	551.3	117.01%	Yes	FP	Prod
9/25/94	-7	-5.75%	114.8	121.8	134	90.90%	No	CP	Prod
9/25/94	-1.7	-1.53%	109.6	111.3	114.8	96.95%	No	FP	Prod
10/25/94	188.7	19.69%	1147	958.3	897.3	106.80%	Yes	FP	Prod
10/25/94	85.5	9.51%	984.5	899	945.3	95.10%	No	FP	Prod
10/25/94	36.5	12.47%	329.1	292.6	248.9	117.56%	Yes	FP	Prod

11/25/94	20.1	4.48%	468.7	448.6	199.6	224.75%	Yes		CP	DEV
11/25/94	-1	-0.44%	224.4	225.4	215.1	104.79%	Yes		CP	DEV
11/25/94	-25.8	-5.52%	441.7	467.5	491	95.21%	Yes		FP	Prod
12/25/94	6.7	2.88%	239.6	232.9	238.8	97.53%	No		FP	Prod
12/25/94	36.5	5.02%	764	727.5	756.1	96.22%	No		FP	Prod
12/25/94	88.1	16.01%	638.5	550.4	611.6	89.99%	No		FP	Prod
12/25/94	16	10.70%	165.5	149.5	180.8	82.69%	No		FP	Prod
12/25/94	106.4	7.75%	1478.5	1372.1	1447.7	94.78%	No		FP	Prod
12/25/94	127.6	14.73%	993.6	866	881	98.30%	No		FP	Prod
1/25/95	5.2	0.49%	1067.7	1062.5	1095.3	97.01%	No	Yes	CP	Prod
2/25/95	-2.5	-3.20%	75.7	78.2	86.1	90.82%	No	Yes	CP	DEV
2/25/95	41.7	5.39%	816	774.3	853.8	90.69%	No	Yes	FP	Prod
3/25/95	1.7	3.46%	50.9	49.2	44.6	110.31%	Yes	Yes	CP	DEV
3/25/95	1.2	1.31%	93.1	91.9	117.3	78.35%	No	Yes	FP	Prod
3/25/95	51.5	11.47%	500.4	448.9	287.8	155.98%	Yes	Yes	FP	Prod
4/25/95	-3.1	-15.90%	16.4	19.5	19.5	100.00%	No	Yes	CP	Mix
4/25/95	5.7	3.53%	167.1	161.4	165.7	97.40%	No	Yes	FP	Mix
4/25/95	22.3	8.23%	293.1	270.8	228	118.77%	Yes	Yes	FP	Prod
5/25/95	2.7	0.96%	282.5	279.8	285.2	98.11%	No	Yes	CP	DEV
6/25/95	27.2	37.94%	98.9	71.7	72.8	98.49%	No	Yes	Mix	DEV
6/25/95	194.6	40.70%	672.7	478.1	485.5	98.48%	No	Yes	CP	DEV
7/25/95	30.3	2.21%	1400.9	1370.6	1406.1	97.48%	No	Yes	FP	Prod
7/25/95	0.3	0.29%	102.2	101.9	102.7	99.22%	No	Yes	FP	Prod
8/25/95	11.8	10.63%	122.8	111	65.8	168.69%	Yes	Yes	FP	Prod
8/25/95	11.4	19.16%	70.9	59.5	66.6	89.34%	No	Yes	FP	Prod
8/25/95	17.7	10.66%	183.8	166.1	127.7	130.07%	Yes	Yes	CP	DEV
8/25/95	1.9	2.07%	93.7	91.8	93.8	97.87%	No	Yes	CP	DEV
9/25/95	1.8	3.74%	49.9	48.1	34.3	140.23%	Yes	Yes	CP	DEV
9/25/95	-0.1	-0.35%	28.7	28.8	29	99.31%	No	Yes	CP	DEV
9/25/95	8.2	2.43%	345.4	337.2	373.1	90.38%	No	Yes	CP	Operations
9/25/95	2.7	1.09%	250.6	247.9	264.6	93.69%	No	Yes	FP	Prod
10/25/95	114.1	30.28%	490.9	376.8	386.3	97.54%	No	Yes	CP	DEV
10/25/95	29.1	10.28%	312.3	283.2	236.4	119.80%	Yes	Yes	FP	Prod
10/25/95	0.7	3.18%	22.7	22	24.2	90.91%	No	Yes	CP	Dev
10/25/95	-7.9	-9.23%	77.7	85.6	89.3	95.86%	No	Yes	CP	Dev
11/25/95	-4.4	-3.83%	110.6	115	116.1	99.05%	No	Yes	Mix	Prod
11/25/95	-36	-7.04%	475.2	511.2	526.8	97.04%	No	Yes	FP	Prod
11/25/95	-2.6	-1.82%	140.3	142.9	155.9	91.66%	No	Yes	CP	
12/25/95	72.6	46.60%	228.4	155.8	157.8	98.73%	No	Yes	FP	DEV
1/25/96	2972.4	57.36%	8154.7	5182.3	5547.9	93.41%	No	Yes	FP	DEV
2/25/96	26.1	31.11%	110	83.9	89	94.27%	No	Yes	CP	DEV
3/25/96	7.5	12.93%	65.5	58	57.6	100.69%	Yes	Yes	FP	Prod
4/25/96	12.1	10.82%	123.9	111.8	118.9	94.03%	No	Yes	CP	DEV
4/25/96	-11.5	-1.80%	628.5	640	659.5	97.04%	No	Yes	CP	Prod
4/25/96	52.1	8.86%	640.1	588	632	93.04%	No	Yes	Mix	Prod
4/25/96	33	35.68%	125.5	92.5	95.8	96.56%	No	Yes	Mix	Dev
5/25/96	0.7	0.17%	418.5	417.8	424.1	98.51%	No	Yes	CP	DEV
5/25/96	-83.3	-7.10%	1089.4	1172.7	1099.8	106.63%	Yes	Yes	FP	Prod
5/25/96	42.5	4.39%	1009.6	967.1	965.9	100.12%	Yes	Yes	FP	Prod
6/25/96	35.5	3.28%	1118.6	1083.1	953	113.65%	Yes	Yes	FP	DEV

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6/25/96	-0.4	-0.70%	56.8	57.2	58.3	98.11%	No	Yes	CP	Prod
6/25/96	-4.5	-0.84%	531.1	535.6	563	95.13%	No	Yes	FP	Prod
6/25/96	-1.2	-2.88%	40.4	41.6	43.8	94.98%	No	Yes	CP	Training
7/25/96	1.3	7.93%	17.7	16.4	17.1	95.91%	No	Yes	Mix	DEV
7/25/96	-3.7	-0.27%	1382.7	1386.4	1421.2	97.55%	No	Yes	FP	Prod
7/25/96	474.6	5.12%	9751.9	9277.3	10514.3	88.24%	No	Yes	FP	Mix
8/25/96	13.9	1.96%	722.8	708.9	735.3	96.41%	Yes	Yes	CP	DEV
8/25/96	-5.3	-7.91%	61.7	67	67.6	99.11%	No	Yes	FP	Prod
8/25/96	4	3.26%	126.8	122.8	162	75.80%	No	Yes	CP	
9/25/96	0	0.00%	60.9	60.9	68.5	88.91%	No	Yes	CP	DEV
10/25/96	5	5.39%	97.7	92.7	97.6	94.98%	No	Yes	CP	DEV
10/25/96	-0.6	-0.81%	73.7	74.3	76.2	97.51%	No	NO	CP	DEV
10/25/96	0.2	0.26%	77.1	76.9	77.2	99.61%	No	NO	CP	Dev
11/25/96	10.5	11.39%	102.7	92.2	92	100.22%	No	Yes		Mix
11/25/96	-63.5	-3.18%	1936.4	1999.9	1911	104.65%	Yes	Yes	FP	Prod
12/25/96	3.5	15.98%	25.4	21.9	21.9	100.00%	No	Yes	CP	DEM/VAL
12/25/96	3.4	14.05%	27.6	24.2	24.1	100.41%	No	Yes	CP	DEM/VAL
12/25/96	56	0.28%	19765.1	19709.1	10014.8	196.80%	Yes	Yes	CP	DEV
12/25/96	-67	-0.61%	10895.7	10962.7	11779.5	93.07%	Yes	Yes	FP	Prod
12/25/96	2.6	5.86%	47	44.4	47	94.47%	No	Yes		
1/25/97	11.9	9.88%	132.3	120.4	127.8	94.21%	No	Yes	CP	DEV
2/25/97	8.1	7.26%	119.6	111.5	104.6	106.60%	Yes	Yes	FP	Prod
2/25/97	26.6	18.22%	172.6	146	149.6	97.59%	No	Yes	CP	DEV
2/25/97	13.3	5.88%	239.4	226.1	259.5	87.13%	No	Yes	CP	PDRR
2/25/97	69.6	78.82%	157.9	88.3	80.2	110.10%	Yes	Yes	Mix	Prod
4/25/97	-3.5	-0.19%	1825.5	1829	1855.6	98.57%	No	Yes	CP	DEM/VAL
4/25/97	-5.6	-1.13%	488.9	494.5	520.6	94.99%	No	Yes	CP	Prod
5/25/97	15.7	8.54%	199.6	183.9	189.3	97.15%	No	Yes	FP	Prod
5/25/97	-31.9	-6.70%	444.4	476.3	512.7	92.90%	No	Yes	FP	Prod
5/25/97	1	0.13%	767.8	766.8	706.2	108.58%	Yes	Yes	FP	Prod
6/25/97	12.8	11.55%	123.6	110.8	122.5	90.45%	No	Yes	FP	DEV
7/25/97	87.6	15.61%	648.6	561	561	100.00%	No	Yes	FP	Prod
7/25/97	26.1	8.67%	327.1	301	329.1	91.46%	No	Yes	FP	Prod
8/25/97	-3.1	-4.47%	66.3	69.4	70	99.14%	No	Yes	CP	Mix
8/25/97	0.8	2.05%	39.9	39.1	39.3	99.49%	No	Yes	CP	Mix
8/25/97	-19.6	-18.63%	85.6	105.2	109.8	95.81%	No	Yes	CP	Dev
8/25/97	-3.8	-4.09%	89.2	93	94.8	98.10%	No	NO	FP	Prod
8/26/97	9.9	5.26%	198.1	188.2	202	93.17%	No	Yes		Prod
9/25/97	145.6	39.00%	518.9	373.3	382.1	97.70%	No	Yes	CP	PDRR
9/25/97	225.5	20.11%	1346.6	1121.1	1060.4	105.72%	Yes	Yes	FP	Prod
10/25/97	-1	-1.22%	81.1	82.1	98.3	83.52%	No	NO	CP	Closure
10/25/97	3.9	2.20%	180.8	176.9	228.3	77.49%	No	Yes	Mix	Prod
10/25/97	-57.4	-11.92%	424	481.4	500.6	96.16%	No	Yes	CP	Mix
11/25/97	49.7	19.66%	302.5	252.8	255.6	98.90%	No	Yes	FP	DEV
11/25/97	1	1.22%	83.1	82.1	85.9	95.58%	No	Yes	FP	DEV
11/25/97	2.7	1.84%	149.7	147	157	93.63%	No	NO	Mix	Prod
11/25/97	13	57.02%	35.8	22.8	26.3	86.69%	No	NO	CP	Prod
12/25/97	9.6	1.24%	786.4	776.8	676.5	114.83%	Yes	Yes	FP	Prod
1/25/98	-0.1	-0.34%	29.4	29.5	29.6	99.66%	No	NO	CP	DEV
1/25/98	181.3	28.47%	818.2	636.9	632.9	100.63%	Yes	Yes	FP	Prod

2/25/98	-0.9	-2.72%	32.2	33.1	41.7	79.38%	No	Yes	CP	DEV
3/25/98	18.3	30.65%	78	59.7	60.9	98.03%	Yes	Yes	CP	DEV
3/25/98	20.2	17.26%	137.2	117	120.2	97.34%	No	Yes	CP	DEV
4/25/98	6.9	4.04%	177.5	170.6	219.2	77.83%	No	Yes	CP	Prod
4/25/98	-19.6	-5.71%	323.5	343.1	382.2	89.77%	No	Yes	CP	Prod
5/25/98	2.4	5.17%	48.8	46.4	46.5	99.78%	No	Yes	CP	DEV
5/25/98	9.5	4.78%	208.2	198.7	233.9	84.95%	Yes	Yes	CP	DEV
5/25/98	6.8	3.91%	180.7	173.9	219.3	79.30%	No	Yes	CP	
7/25/98	7.4	13.03%	64.2	56.8	76.1	74.64%	No	Yes	CP	DEV
7/25/98	25.1	5.96%	446.5	421.4	442.8	95.17%	No	Yes	CP	DEV
7/25/98	8.2	14.94%	63.1	54.9	55.5	98.92%	No	Yes	CP	DEV
8/25/98	-0.2	-2.13%	9.2	9.4	10.9	86.24%	No	NO	Mix	Prod
8/25/98	-3.3	-0.61%	534.9	538.2	552.4	97.43%	No	Yes	FP	Prod
9/25/98	6	9.71%	67.8	61.8	65.1	94.93%	No	Yes	Mix	DEV
9/25/98	0.9	0.92%	99.2	98.3	113.7	86.46%	No	Yes	CP	DEV
9/25/98	-7.3	-3.50%	201.5	208.8	223.8	93.30%	No	NO	CP	Planning
9/25/98	109.3	13.50%	919	809.7	843.9	95.95%	Yes	Yes	FP	Prod
10/25/98	112	3.55%	3267.6	3155.6	3188.5	98.97%	No	Yes	FP	Prod
11/25/98	65.1	12.27%	595.7	530.6	534.5	99.27%	No	Yes	CP	DEV
11/25/98	4.1	0.83%	498.1	494	421.9	117.09%	Yes	Yes	FP	Prod
11/25/98	-5.7	-2.57%	215.8	221.5	243	91.15%	No	Yes	FP	Prod
11/25/98	0.6	0.46%	131.9	131.3	129.4	101.47%	No	NO	FP	Prod
11/25/98	22.3	9.20%	264.8	242.5	246.8	98.26%	No	Yes	FP	Prod
11/25/98	11.9	9.57%	136.3	124.4	131.5	94.60%	No	Yes	FP	Prod
11/25/98	-6.3	-2.45%	250.5	256.8	283.7	90.52%	No	Yes	FP	Prod

Bibliography

Abba, Wayne. *Earned Value Management Rediscovered!* Washington: GPO: 25
    September 1995. http://www.acq.osd.mil/pm/paperres/standown.html

Adams, Ronald M. *Test Concurrency and the Carlucci Initiatives: When is More Too
    Much?* ACSC Report 84-0020. Air Command and Staff College, Maxwell AFB,
    AL, 1984.

Air Force Material Command (AFMC). *AFMC Financial Management Handbook.*
    Wright-Patterson AFB OH: December 2001
    http://www.deskbook.osd.mil

-----. *Statutory/Policy Changes.* AFMC Acquisition Reform Guide. Wright-Patterson
    AFB OH: 19 February 1999.

Aldridge, E.C. "Pete"., Under Secretary of Defense for Acquisition, Technology and
    Logistics. "Five Goals." Remarks to the Student Body of the Industrial College of
    the Armed Forces. Industrial College of the Armed Forces. 30 April 2002.

Chatfield, Chris. *The Analysis of Time Series* (Fifth Edition). New York: Chapman &
    Hall, 1996.

Cheney, Richard B. *Defense Management Report to the President,* Report written by
    Secretary of Defense, 12 July 1989.

Christensen, David., and Carl Templin. "An Analysis of Management Reserve Budget on
    Defense Acquisition Contracts," *Acquisition Review Quarterly,* pages 191-208
    (Summer 2000). http://www.dau.mil/pubs/arqtoc.asp

-----. "EAC Evaluation Methods: Do They Still Work?" *Acquisition Review Quarterly,*
    pages 105-116 (Spring 2002). http://www.dau.mil/pubs/arqtoc.asp

Congressional Budget Office. *Budget Options for National Defense.* Washington: GPO,
    March 2000. www.cbo.gov

Coopers and Lybrand. *Acquisition Reform Implementation: An Industry Survey.* October
    1997. http://www.acq.osd.mil/ar/clreport.htm

Cordesman, Anthony H. *The Crisis in US Defense Spending: A Reality Check.*
    Washington: CSIS, January 1999.

CRS Report IB96022. *Defense Acquisition Reform: Status and Current Issues by Valerie
    Bailey Grasso,* Washington: Congressional Research Service, The Library of
    Congress, 8 November 2001.

D'Agostino, Ralph B. and Michael A. Stephens. *Goodness-of-Fit Techniques*. New York: Marcel Dekker, Inc., 1986.

Defense Acquisition Executive Summary (DAES) Web, 2002. http://extranet.acq.osd.mil/ara/daes/main.html.

Defense Systems Management College (DSMC). *Clinger-Cohen Act of 1996.,* 2002. http://www.dau.mil/jdam/contents/clinger_cohen.htm

-----. *DoD Directive 5000.1 and DoD 5000.2-R Rewrite.,* 2002 http://www.dau.mil/jdam/contents/dod_5000series.htm

-----. *Earned Value Management Gold Card.* June 2000. http://www.acq.osd.mil/pm

-----. *FAR Rewrite.,* 2002. http://www.dau.mil/jdam/contents/far_rewrite.htm.

-----. *Federal Acquisition Streamlining Act (FASA).,* 2002. http://www.dau.mil/jdam/contents/fasa.htm.

Department of Defense. *CAIV Working Group Report.* Washington: GPO, 1995. www.defenselink.mil

-----. *DoD 5000.2-R Mandatory Procedures for Major Defense Acquisition Programs (MDAPs) and Major Automated Information System (MAIS) Acquisition Programs.* Washington: GPO, 10 June 2001. http://web2.deskbook.osd.mil/reflib/MDOD/031DR/001/031DR001DOC.HTM.

-----. *Earned Value Management Implementation Guide.* Washington: GPO, 3 October 1997. http://web1.deskbook.osd.mil/reflib/ddod/012ez/001/012ez001doc.htm

-----. *FY03 Budget Greenbook*. http://www.dtic.mil/comptroller/fy2003budget/fy03GBpdf.pdf

-----. *Guide to Integrated Product and Process Development (Version 1.0).* Washington: GPO, 5 February 1996.

Devore, Jay L. *Probability and Statistics for Engineering and the Sciences* (Fifth Edition). Pacific Grove, California: Duxbury, 2000.

Drezner, J. A., J. M. Jarvaise, R. W. Hess, P. G. Hough, and D. Norton. *An Analysis of Weapon System Cost Growth.* Santa Monica CA: RAND, 1993 (MR-291-AF).

Druyun, Darlene. *A Blueprint for Action: Final Report*. Defense Reform 2001 Conference. Washington: 15 February 2001.

Ferrara, Joe., and Collie Johnson. "Institutionalizing Integrated Product Teams," *Program Manager,* XXIV, No. 6, DSMC 129: 2-5 (November-December 1995).

Ferrara, Joe. "DoD's 5000 Documents: Evolution and Change in Defense Acquisition Policy," *Acquisition Review Quarterly,* pages 109-130 (Fall 1996). http://www.dau.mil/pubs/arqtoc.asp

"Focused Approach to Affordable Weapon Systems, A," *Program Manager,* XXIV, No.2, DSMC 125:49-52 (March-April 1995).

Gaddis, Don. *Implementation of Cost as an Independent Variable: An AIM-9X Case Study."* MS Thesis, Naval Postgraduate School, Monterey, CA, December 1998

Gansler, Jacques S., Under Secretary of Defense for Acquisition and Technology. "The Single Process Initiative: Its Role In Civil/Military Integration." Speech at the SPI Recognition Awards Ceremony. Defense Logistics Agency, Ft. Belvoir VA. 29 September 1998. http://www.acq.osd.mil/gansler_archives/speech/single_process_initiative.html.

-----. Statement before the Subcommittee on Acquisition and Technology, Senate Armed Services Committee. 18 March 1998 http://www.acq.osd.mil/ousda/testimonies/sasc_march_18.html

General Accounting Office. GAO/NSIAD-96-139. *Acquisition Reform: Regulatory Implementation of the Federal Acquisition Streamlining Act of 1994.* Washington: GPO, 28 June 1996. www.gao.gov

-----. GAO/NSIAD-97-22BR. *Acquisition Reform: Implementation of Title V of the Federal Acquisition Streamlining Act of 1994.* Washington: GPO, 31 October 1996. www.gao.gov

Gibbons, Jean Dickenson. *Nonparametric Statistical Inference* (Second Edition). New York: Marcel Dekker, Inc., 1985.

Gordon, James A. *Does a Rubber Baseline Guarantee Overruns?* MS Thesis, AFIT/GSM/LAS/96S-5, School of Logistics and Acquisition Management, Air Force Institute of Technology (AU), Wright-Patterson AFB OH, September 1996.

Goure, Daniel I. *U.S. Defense Budget: Impact on the U.S. Defense Capability and Defense Industry.* Washington: CSIS, 24 April 2000. www.csis.org/japan/old_japanchairglobal042400.html

Gregory, William H. *The Defense Procurement Mess.* Lexington, Massachusetts: Lexington Books, 1989.

Haupt, Eleanor. Powerpoint Slides, Earned Value Management. Aeronautical Systems
    Command Cost Analysis (ASC/FMCE), Wright-Patterson AFB OH, 2002.

Jones, Wilbur D. Jr. *Arming the Eagle: A History of U.S. Weapons Acquisition Since
    1775,* Fort Belvoir, VA: Defense Systems Management College Press, 1999.

Kaminski, Paul G., Under Secretary of Defense for Acquisition and Technology.
    Statement before the House Committee on National Security on Defense
    Acquisition Reform, 26 February 1997.
    http://www.acq.osd.mil/ousda/kaminski/acq_reform.html

Koreisha, Nicholas A., and Valerie LaPlaca-Mars. "Cost as an Independent Variable
    (CAIV) Acquisition Strategies: A Broad Overview," *Presentation from 9th
    Annual International Cost Schedule Performance Management Conference in
    Tyson's Corner, VA, 19-23 October 1997.* KPMG-Peat Marwick LLP: 22
    October 1997.

Levin, Carl., United States Senator. Statement during Senate Armed Services
    Committee, Readiness Subcommittee hearing on Acquisition Reform. 26 April
    2000. http://levin.senate.gov/floor/042600.htm.

Makridakis, Spyros., Steven C. Wheelwright, and Rob J. Hyndman. *Forecasting
    Methods and Applications* (Third Edition). New York: John Wiley & Sons, Inc.,
    1998.

Munechika, Curtis K. *Acquisition Reform: "This, Too, Shall Pass…?"* ACSC Thesis,
    AU/ACSC/0385/97-03, Air Command and Staff College, Maxwell AFB AL,
    March 1997

National Partnership for Reinventing Government. *Savings Associated with NPR for
    NPR Recommendations Made in 1993 and 1995.* Washington: 27 Oct 1999.
    http://govinfo.library.unt.edu/npr/library/misc/savings.html.

National Performance Review. *Reinventing Federal Procurement.* Washington: 14
    September 1993.
    http://govinfo.library.unt.edu/npr/library/nprrt/annrpt/sysrpt93/reinven.html.

Neter, John., Michael H. Kutner, Christopher J. Nachtsheim, and William Wasserman.
    Applied Linear Statistical Models (Fourth Edition). Boston, MA: WCB McGraw-
    Hill, 1996.

NIST/SEMATECH e-Handbook of Statistical Methods,
    http://www.itl.nist.gov/div898/handbook/eda/section3/eda35a.htm, 10 Feb 2003.

Perry, William J., Secretary of Defense. "Mandate for Change," Testimony before the House Armed Services Committee and the Governmental Affairs Committee. February 1994. http://www.acq.osd.mil

President's Blue Ribbon Commission on Defense Management. *A Quest for Excellence, Appendix,* Washington: President's Blue Ribbon Commission on Defense Management, June 1996.

Searle, David A. *The Impact of the Packard Commission's Recommendations on Reducing Cost Overruns in Major Defense Acquisition Programs.* MS Thesis, AFIT/GCM/LAS/97S-12, School of Logistics and Acquisition Management, Air Force Institute of Technology (AU), Wright-Patterson AFB OH, September 1997

Sheskin, David J. *Handbook of Parametric and Nonparametric Statistical Procedures* (Second Edition). New York: Chapman & Hall/CRC, 2000.

US Congress, Joint Study by the Congressional Budget Office and General Accounting Office. *Analysis of the Grace Commission's Major Proposals for Cost Control,* Washington: GPO, February 1984.

Verrill, Steve Patrick. *Some Asymptotic Results Concerning Censored Data Versions of the Shapiro-Wilk Goodness of Fit-test.* PhD Thesis. University of Wisconsin-Madison, Madison WI, 1981 (3319-89-00035)

Wagner, Gary F., and Randall L. White. *An Investigation of Integrated Product Development Teams of the F-22 Program.* MS Thesis, AFIT/GSM/LAS/93S-19, School of Logistics and Acquisition Management, Air Force Institute of Technology (AU), Wright-Patterson AFB OH, September 1993 (AAK-8737).

Vita

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14. ABSTRACT
This thesis examines the impact of acquisition reform initiatives implemented since 1993 on contract cost performance. This research effort studied 204 contracts completed between January 1, 1994 and December 31, 2001. It was discovered that cost performance for contracts completed after reform initiative implementation was no different than cost performance on contracts completed before implementation. The research also analyzed cost performance on all active contracts from 1970 to 2002 against the backdrop of acquisition reform studies and commissions over the same time period, to examine any trends or time lags between reform implementation and contract cost performance change. The results indicate some evidence of cost performance change following the different studies and commissions.

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